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ABSTRACT

Part of a series of eight student learning modules in vocational agriculture, this booklet deals with crop-related activities. The first section is on harvesting methods and equipment. The following portions address the handling, grading, and packing of crops; and the classification and selection of fruits, vegetables, and ornamental plants. There is a quiz at the conclusion of each portion of text. (PLB)

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HARVESTING METHODS AND EQUIPMENT

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Early Harvesting Methods

Prior to about 1860, approximately seventy-five percent of the total population lived on farms. There was an abundance of hand labor to harvest the crops. Actually, hand harvesting methods were practiced as a part of crop production as late as 1930, even though the reaper went on the market in 1836. This early piece of equip-

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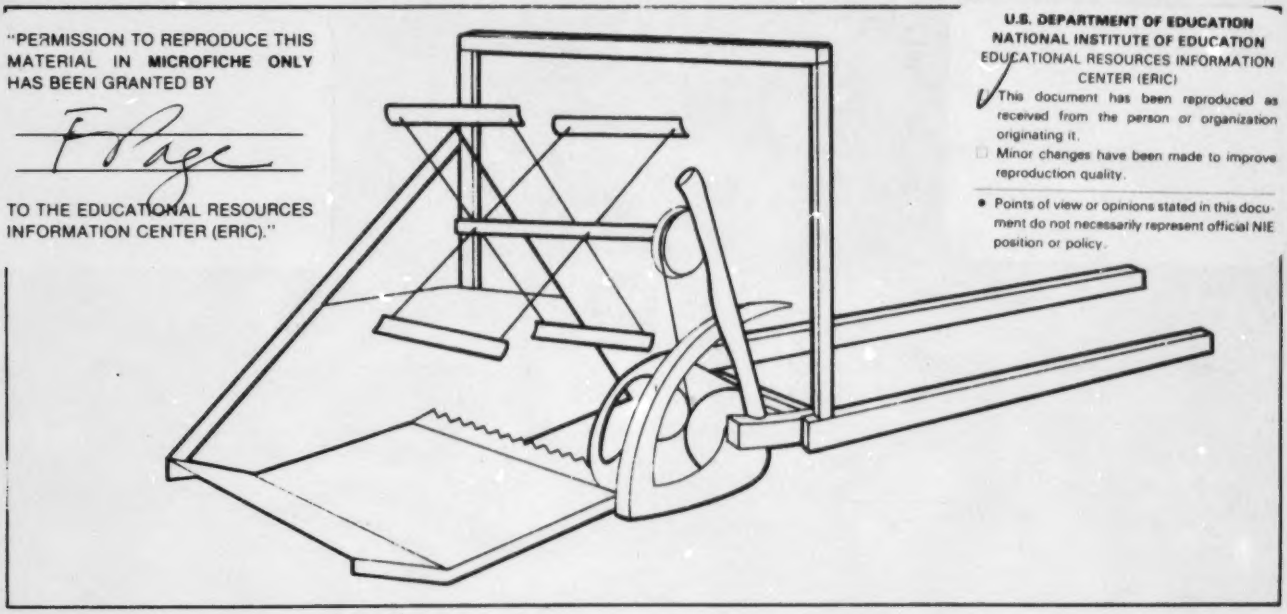

ment took the place of the scythe and cradle. Two men operating a reaper could cut twice as much grain as when using the scythe. During the year 1860, about 20,000 reapers were sold to harvest the small grain crops. Binders, mowers, rakes, and combines later followed the reaper. This type of equipment also helped replace the cradle, hand sickle, and knife used for harvesting small grain. Cotton strippers and pickers eliminated hand pulling and picking, and the mechanical potato digger replaced the hoe used to harvest potatoes. Modern combines, balers, forage harvesters, cotton pickers, vegetable harvesters, and fruit harvesters which have replaced stationary harvesting equipment are mobile.

Before about 1930, the harvesting of grain was considered a very large farm task due mainly to the following procedures being used:

Grain was cut by a horse drawn mower.
Grain stalks (with seed) were raked into rows by a horse drawn rake.
A sweep rake (horse drawn) hauled the seed-carrying stalk to the thresher. The entire stalk was fed into the stationary thresher by hand. Similar steps were used in making hay. For example: hay was cut, windrowed, and baled.

Early hay balers and forage harvesters were stationary equipment. The crop, usually the stalk and seed, had to be transported to the machine for completion of the harvesting process. Harvesting of crops was considered one of the most tiring types of farm hand-labor until mechanized harvesting equipment replaced hand labor and

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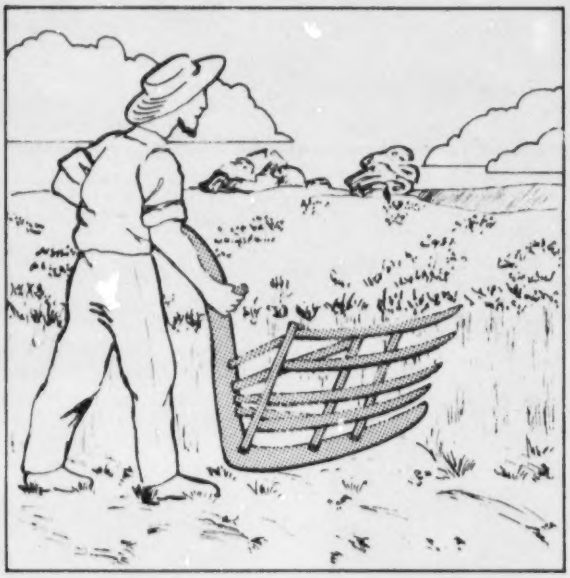


horse drawn equipment. With all harvesting conditions favorable, two men could cut and bind 2 1/2 acres of small grain per day with a cradle. A horse drawn binder could cut and tie about 10 acres of small grain per day. Large mobile type combines which are in use today can harvest hundreds of acres per week, depending on the length of the cutter bar.

Grain is no longer harvested while the heads are yellow (wheat, oats, etc.) or light brown (some sorghums) or just after the stalk has turned from its green color, because grain is just past the dough stage when harvested at these times. When combines are used for harvesting, grain must be hard and dry. These machines dated almost as far back as the reaper, but they failed to make the continued and improved progress made by the binder and thresher or harvester. In the 1880's combines were used in the Middle West to cut and thresh wheat. They really became useful after gasoline power was made available.

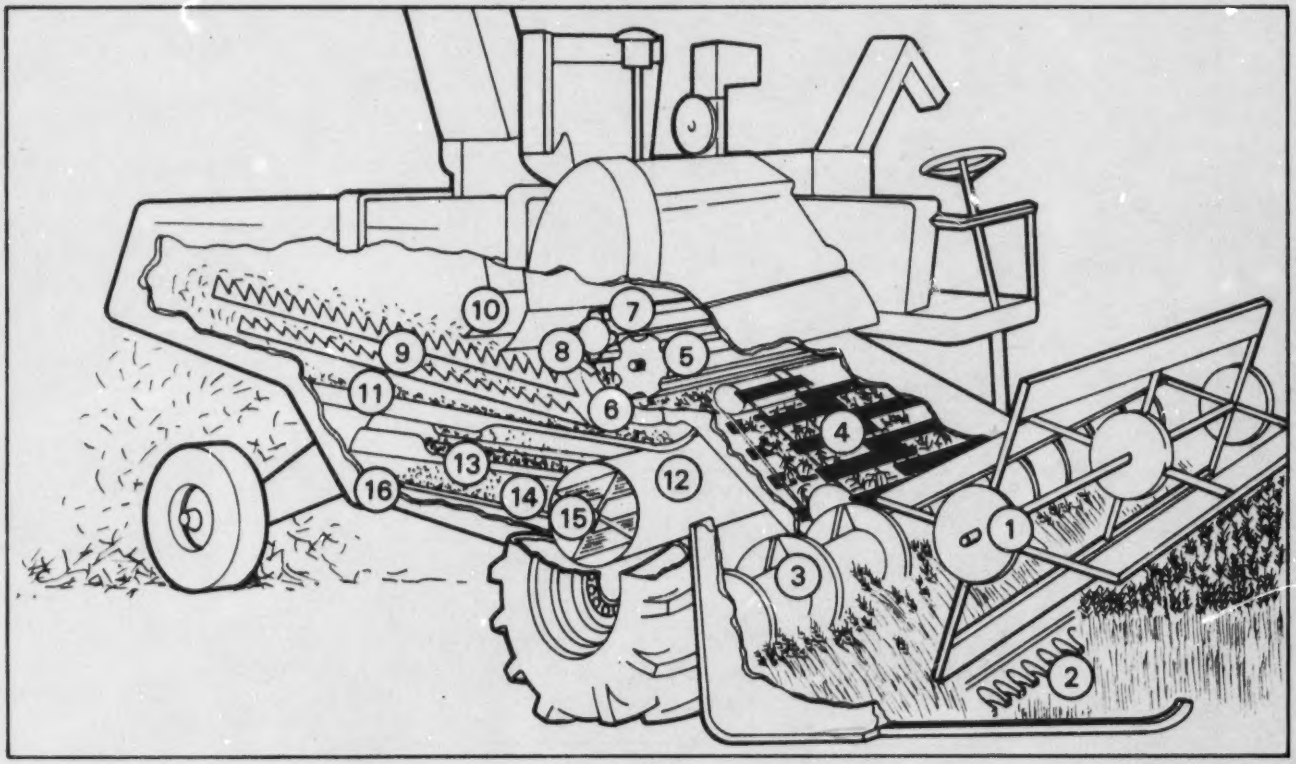
Some Methods of Harvesting

Combining

The combine is the most widely used machine today. The mower-thresher combination unit performs several harvest operations. The stalk or a portion of the stalk is cut, grain threshed, and transferred to a bin or is sacked, and the straw or waste is distributed in windrows or scattered over the ground. Combines are used to harvest such crops as grain sorghums, wheat, barley, rye, oats, rice, flax, soybeans, peas, and many other seed crops. There is a great difference of time used to harvest one acre of wheat by hand and by machine. A comparison of harvest man-hours is:

Cutting with sickle	14 hr.	Cutting with cradle	5 hr.	Cutting with McCormick's first (4 1/2 ft.) reaper	2 hr.	Cutting with 5-ft. grain binder	3/4 hr.	14 ft. combine	1/2 hr.
Binding by hand	5 hr.	Binding by hand	5 hr.	Binding by hand	5 hr.	None		None	
Shocking	1 hr.	Shocking	1 hr.	Shocking	1 hr.	Shocking	1 hr.	None	
Threshing with flail	13 hr.	Threshing with flail	13 hr.	Threshing with flail	13 hr.	Stationary thresher	1 1/4 hr.	None	
Windrowing rod and sheet	10 hr.	Windrowing rod and sheet	10 hr.	Windrowing rod and sheet	10 hr.	None		None	
Gathering and sacking	3 hr.	Gathering and sacking	3 hr.	Gathering and sacking	3 hr.	None		None	
	46 hr.		37 hr.		34 hr.		3 hr.		1/2 hr.

It took about 46 hours to harvest one acre when cutting with a sickle, whereas only one-half hour is used today to harvest one acre of grain. The operating cycle of a combine is as follows:

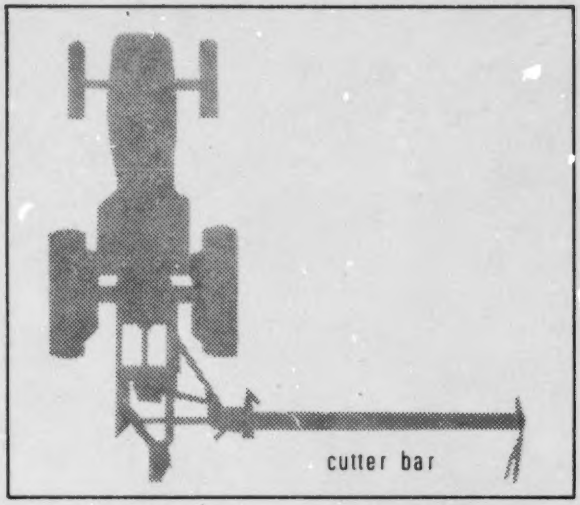


The reel (1) momentarily holds the crop against the guards until the knife (2) cuts the stems, and then sweeps the cut material onto the platform. The platform auger (3) delivers the cut grain to the feeder (4) which carries the cut grain to the cylinder (5). The grain is rubbed out of the head between the rotating cylinder (5) and the concave grates (6). The cylinder beater (7) strips the cylinder, continues separating loose kernels of grain through the finger grate (8) then moves the material onto the straw rack (9) where final separation takes place. The adjustable cylinder beater check flap (10) regulates the flow of material over the racks. The grain pan (12) catches the grain separated at the concave cylinder beater grate, and returns it from the straw racks and delivers it to the chaffer (11). The cleaning fan (15) supplies the wind blast which is the medium of separation. The shoe and sieve (13) operate directly opposite to the grain pan and chaffer which assures double action cleaning (as the grain pan and chaffer moves forward, the shoe and shoe sieve move towards the rear). The shoe sieve (13) is where the final cleaning takes place. The threshed grain falls through the chaffer, shoe sieve, and into the grain trough (14) where it is moved to the grain elevator by the grain auger. The grain elevator conveyor chain then delivers the clean grain to the grain tank. Unthreshed heads will move rearward across the chaffer and shoe sieve and drop into the tailings return auger trough (16). From this point, the unthreshed heads are returned by the tailing elevator to the cylinder for rethreshing. Combines can be adjusted to harvest many different kinds of crops by changing the size of sieves and adding special attachments for the crop. For example, grain sorghums may be harvested by using a 9/32" round hole sieve with no extra equipment, whereas wheat will require a 1/8" x 3/4" oblong sieve with fan inlet screen and roto cleaner with proper screen.

Hay Harvesting

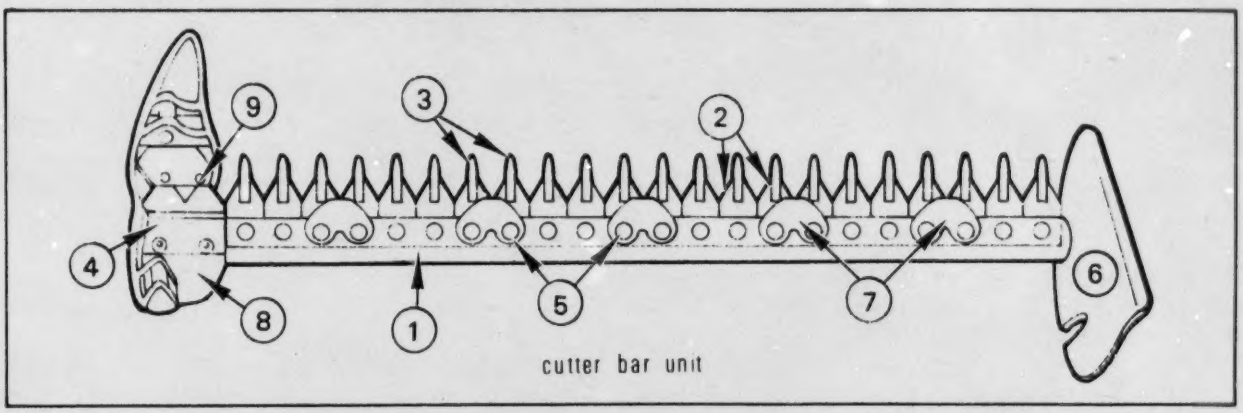
Hay is harvested in several different ways for local use and marketing. Three of the most common ways of harvesting are small rectangular bales, round bales, and cubes. In most areas of the country hay is cured under natural conditions. However, in a few areas drying systems have been developed to dry half-cured (35 to 40 percent moisture) hay.

The most common hay harvesting equipment includes the following:

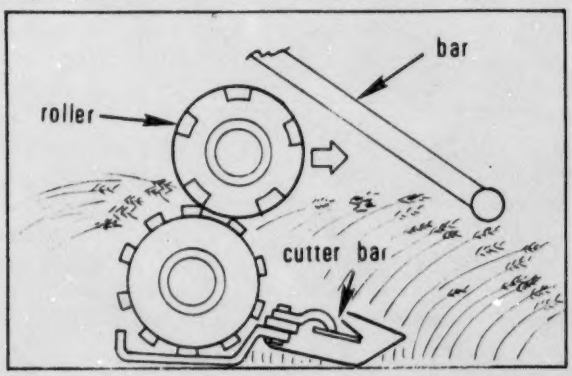


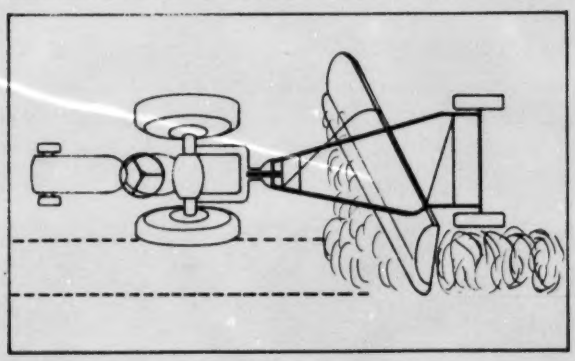
Mowers -

The cutter bar mower is very common to most methods of harvesting hay. It may be mounted as a single unit at the rear of the tractor and operated off the power take-off mounted on other cutting types of equipment. The main cutter bar assembly include the bar (1), knife sections (2), guards (3), knife head (4), wearing plates (5), outer shoe (6), knife clips (7), inner shoe (8), and knife caps (9).



A special type of rotary mower is also used to cut hay. It operates similarly to the flail mower which uses impact force to cut the plants. Another type of mower that is used in hay producing areas is the combination unit that cuts with a standard cutter bar and either crimps or crushes the plant as it passes between two rollers. As illustrated, a front bar pushes the plant forward causing the butt of the plant to enter the rollers. Hay dries more rapidly after it is crushed. In fact, drying can be speeded up as much as 50 percent. As the hay passes through the machine it is worked toward the center by windrow shields before being dropped to the ground, forming a row appearance.

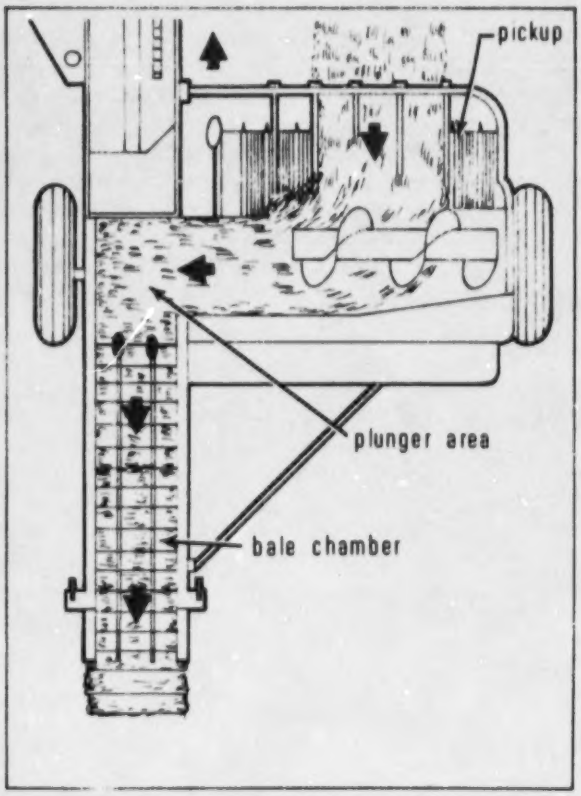




Rakes -

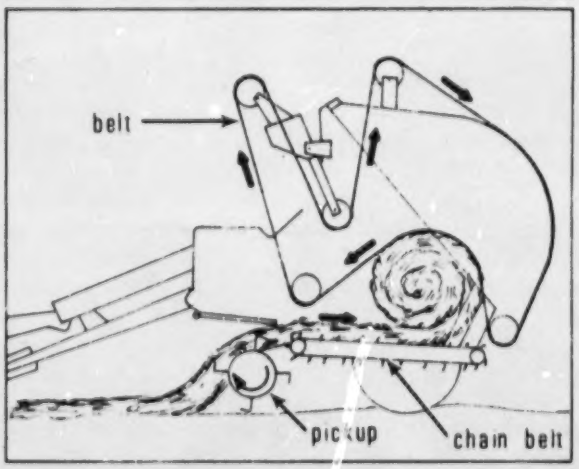
If a regular windrower is not used, the hay must be raked into windrows. The parallel-bar type side delivery rake is most commonly used. However, another very popular rake is the wheel type side delivery. They can be used on sparse crops where the ground is rough. Dump and buck rakes are used mainly to move loose hay from one location to another. They are used mounted on the front of a tractor and operated by a hydraulic system. The parallel-bar rake has from four to six bars on two

parallel plates. The teeth give a sweeping motion as they move down on the plates. This type of rake will cover a width of about nine feet. The wheel type rake has teeth mounted around each of the several wheels.

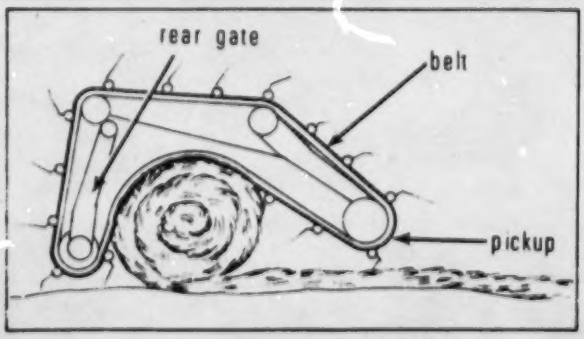


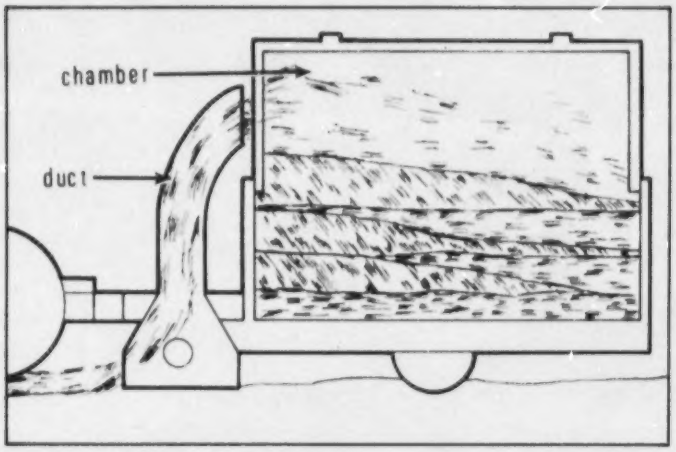
Balers -

Rectangular balers take up hay from windrows, compress it, and tie the bales with two or three strands of sisal, hemp, plastic, or 15 gauge wire. Hay is fed into a chamber, compressed by a plunger, and cut to a standard width (14 to 18 inches) and may vary in length (36 to 48 inches) and weigh from about 60 to 75 pounds. The illustration shows a baler equipped with an auger for feeding the hay into the press, but some balers have a carrier-roller feeding system. Most balers are equipped to operate from the power take-off of a tractor.



Round balers are being used more each year. Less manpower but special equipment is needed to handle round bales. Other advantages of using round bales are: no special storage building is needed, manpower needed for hauling is reduced, and frequency of feeding is reduced. This type of baler forms a round bale by taking hay from a windrow and rolling it into a tight round shape. The hay is tied with sisal or plastic. Bales are usually transported from the hay field to a storage area (outside or under open sheds) by using a fork lift on a tractor or special bale movers hooked to tractor or pickup. As previously illustrated, one type of round baler lifts the hay from the ground and elevates it to a chain type apron where a belt rolls the incoming layer of hay into a bale. In the second round baler illustration is a roll-on-the-ground machine. There are several different sizes of round balers. The most common is the 1500-pound bale size.





Another type of baler is known as the stack-wagon. This is the largest of all balers. The two types are the mechanically-compressed and the air-packed. The stack-wagon is usually pulled by a large tractor over the center of the hay windrow. Hay is picked up and blown into the chamber in stages where it is compressed with a power pack. The mechanically-pressed stacks vary from one to ten tons in size. When the compression chamber is full of hay, the stack is delivered to the storage site or feeding area where it is power unloaded. The measurement of small stacks are about 7 feet wide, 8 feet long, and 8 feet high. Large stacks are 8 feet wide, 20 feet long, and 11 feet high. Stack-wagon bales may weigh over one and one-half tons.

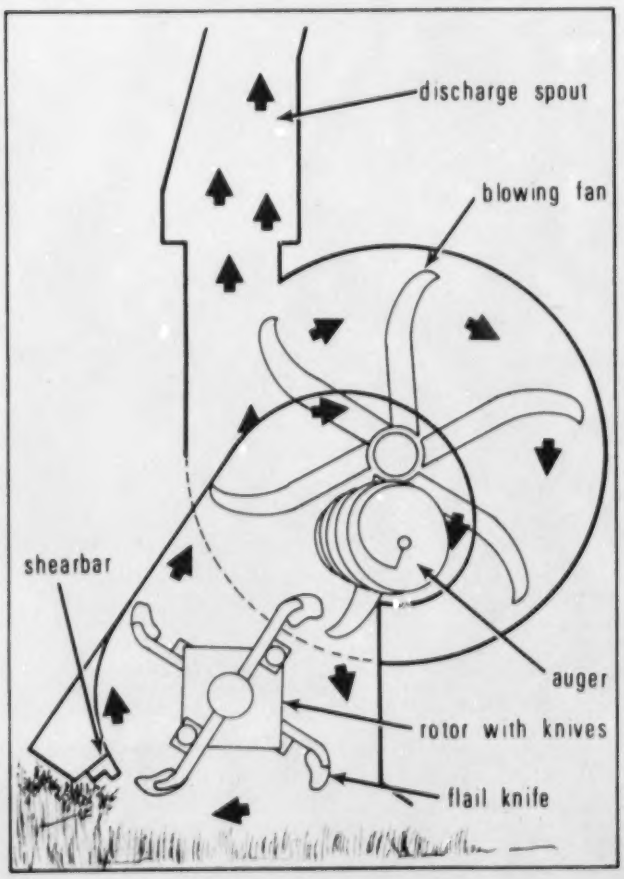
Hay Moving Equipment -

Flat bed trailers, pick up and delivery bale handlers, three point tractor bale movers, and front-end tractor loaders are necessary to properly handle hay.

Field Cubers -

This machine takes up hay from the windrow, moistens the dry hay, cuts it into about 1 1/2-inch lengths, and forces the cut hay through a small die. Cubes are discharged into a hopper from the cubing machine. They are usually stored in bins (rooms). This is one reason cubes are preferred to hay in a livestock feeding program; less space is needed. Cubes or wafers can also be handled more easily than hay. When cubes and wafers are stored, they contain 15 percent or less moisture.

Ensiling



Ensiling is a method of harvesting forage crops in the green stage so that the forage can be used as a succulent feed.

The small chopped pieces of forage plants are usually stored in silos. Corn, sorghums, certain grasses, clover and vetches are used as silage crops. The two types of ensiling machines (forage harvesters) are: field choppers and flail choppers. The field chopper is by far the most versatile of the two types. This versatility comes from its ability to harvest both row and broadcast crops. The three processes involved in the operation of a forage harvester are:

Cutting and feeding
Chopping
Blowing

The forage is chopped or cut in the machine either by a flywheel or cylinder cutter. In some cylinder cutters, the knives may resemble a reel type lawn mower. Cutting takes place as the knives reach the shear plate. In other types, flail knives do the cutting against a shearbar as shown in the illustration. The feeding and cutting mechanism will vary according to the type unit attachment used on the harvester. If a row crop unit is used, the plants are cut by an oscillating sickle cutter. If a broadcast unit attachment is used, a mower-like cutter-bar cuts the crop. A reel is used to throw the severed plant against an apron which carries the forage back to an auger. The auger in turn carries the material to the chopping unit. The crop is chopped and blown into a

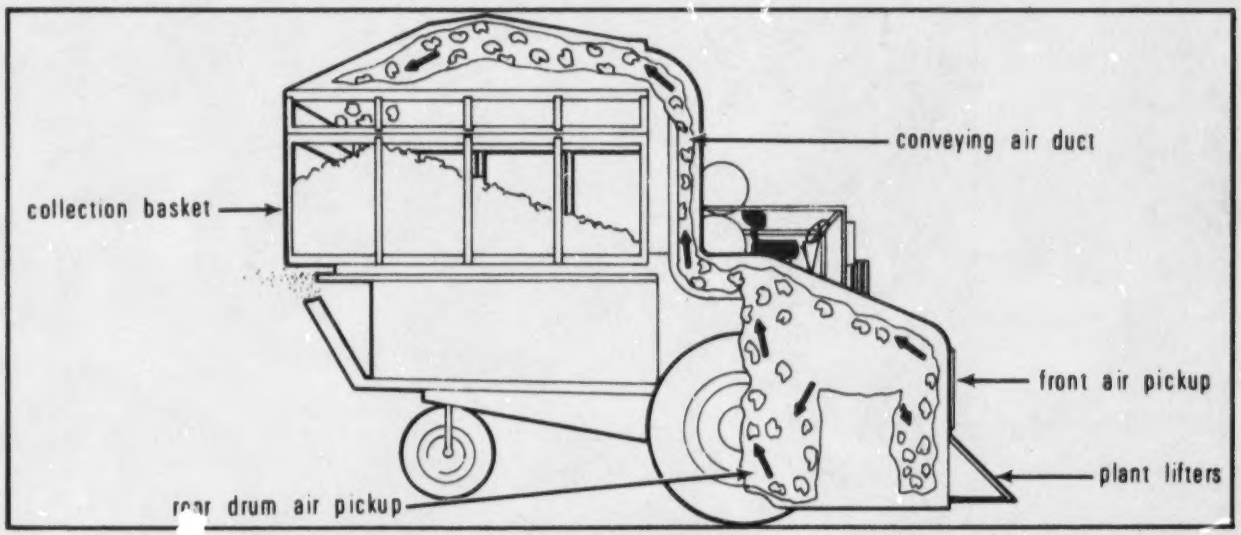
trailing hopper. If a windrow pickup is used, revolving fingers lift the forage from the windrow and move the hay to the auger. The auger in turn moves the forage to the chopping mechanism. The unit is usually powered through the PTO and the tractor.

Cotton Pickers and Strippers

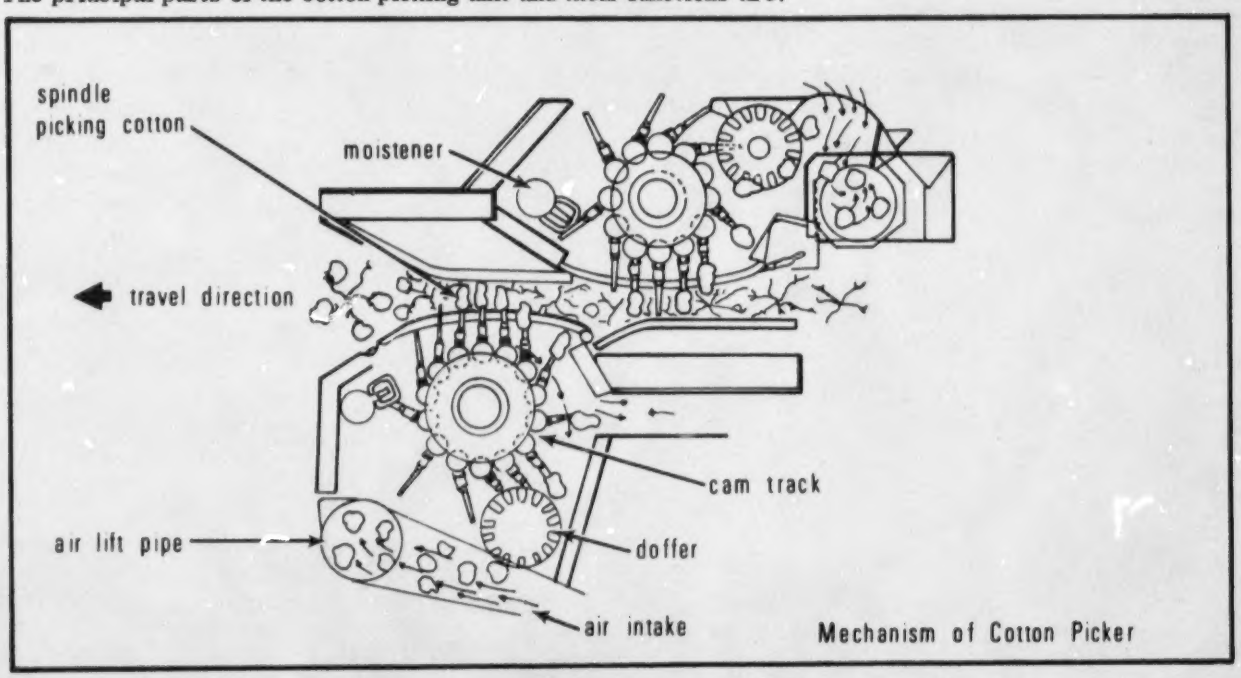
Cotton Pickers -

A cotton picker moves the seed cotton (seed and lint) from the open dried burr. It performs the same type of work that was once accomplished by hand labor.

Pickers may be classified according to the way they are powered. There are cotton-picking units (one and two row) that are made to mount on tractors. The most modern type unit is self-propelled. The mechanical features of different brand names may be different. The main differences are the number of rows harvested, type of spindles, height of drums, and method of mounting pickers on tractors. The basic units of a picker are: the picking unit, fan delivery system, platform, controls, and the cotton basket.



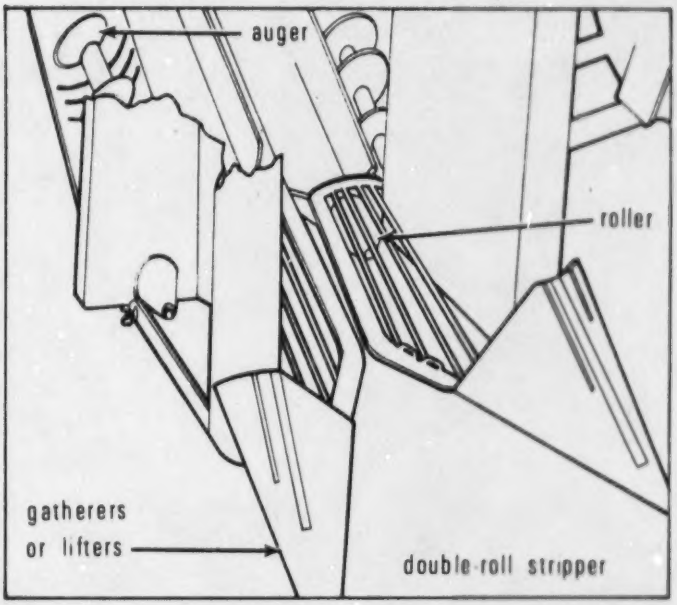
The most modern cotton pickers are equipped with an enclosed cab and are usually heated and air conditioned. The principal parts of the cotton picking unit and their functions are:



Mechanism of Cotton Picker

Stalk lifters, spring fingers, and grid bars move cotton stalks into the picking zone. In the picking unit there are from 12 to 20 spindles per bar and 12 to 16 bars per drum. There is one drum for each side of the row. The spindles rotate at 90 degrees to the direction of travel as they entangle and extract seed cotton from the open burrs. Doffers remove the cotton from tapered spindles after they leave the plant. The stationary rubber face doffers drop the seed cotton so that it can be picked up by air from the conveyor. Cotton from straight spindles is removed by stripper bars as the spindle passes the bar. The rubber cleaning pads are moistened as they clean the spindles. Cotton is conveyed to the carrying baskets by a fan that draws cotton from the drum through conveyor pipes. Dirt and trash are extracted from the cotton through grates by the air blast before it reaches the carrying baskets.

Cotton Strippers -

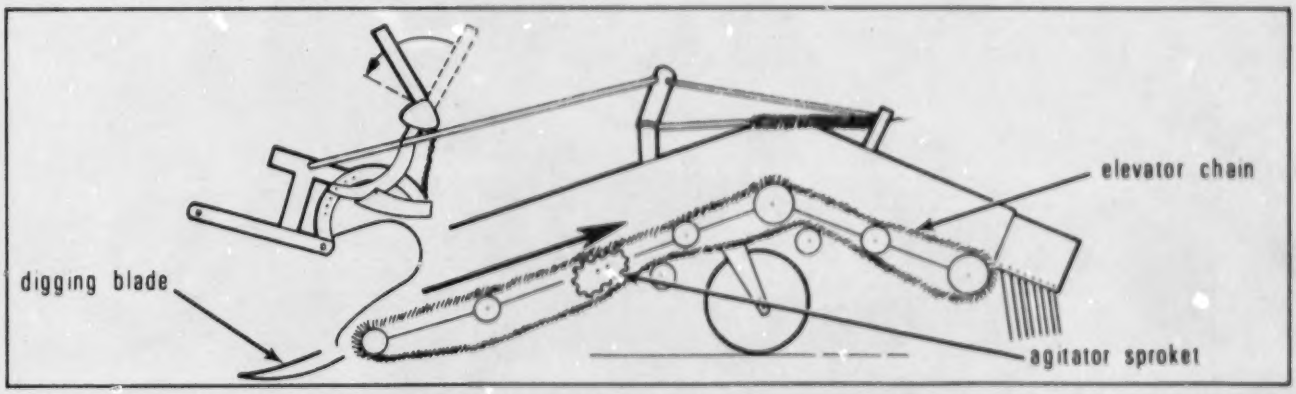


The general appearance of a cotton stripper resembles that of a cotton picker. The entire open boll which contains fiber and seed is removed from the plant by the stripper. Before a successful stripping job can be accomplished, plant leaves must be removed by either defoliation or by frost. Most cotton strippers are made to harvest stormproof cotton (lint not fluffy and held tight in boll). The two most commonly used strippers are the single and double roll and tine or finger type. Some types of strippers are mounted on tractors or pulled by tractors.

The latest and most modern models are self-propelled. The major parts of a roll stripper are: pick up grates or lifters, roll or rolls and bars, auger conveyor, pressure plates, fingerbeaters, fan, and conveyor chutes. The tine-type stripper parts include: pick up and stripping fingers, upper and lower beater conveyors, cleaner screen, auger, and conveyor chute.

Digging Roots and Tubers

The potato digger changed potato production from a garden project to a commercial enterprise. There are 1 and 2 row machines pulled behind a tractor. The digging blades and shaking apron are operated from the power take-off. Most diggers deposit potatoes on the ground to permit the skin to dry before they are placed in crates or sacked by hand. Some of the larger machines deposit the potatoes in a tank mounted on the machine and others deliver the potatoes onto a truck driven close to the harvester. Most commercial potato producers destroy the vine before harvest by using a chemical or a flailtype beater.



The potato digger operates by running the blade below the potatoes. Soil and potatoes move upon the belt or elevator. As the elevator chain is moved up and down by the agitator, soil is removed. A continuous chain belt is shown in the illustration. Some potato harvest machines have more than one chain belt.

Other root-harvesting equipment includes sweet potato harvesters, sugar beet harvesters, and peanut diggers and combines. There are machines that dig, shake, windrow, and invert peanuts, whereas others only dig or shake the vines. The two main types of machines that are used to separate the peanut from the vine are threshers and pickers. The thresher has teeth similar to teeth on a grain thresher, which are straight. Yet, they are spaced much farther apart on the cylinder and concave bars. The cylinder and concave bars on a picker have spring teeth. Peanut combines are both tractor-drawn and self-propelled. They may be equipped with a holding tank or bagging attachments. Usually combined peanuts must be dried before being placed in storage.

Other Types of Harvesting Equipment

Sugar-cane harvesting equipment is used as follows: dead leaves are removed by burning. Then a heavy (16,000 lb.) self-propelled machine enters a burned over field, cuts the thick stalks near the ground, and removes the tops by power-operated knives. Cane is placed in windrows by the harvester. A special loader picks up the cleaned stalks, which may be 8 to 12 feet long, and loads them on a special trailer or truck designed for hauling cane.

Fruit harvesting machines include tree shakers which are used to loosen nuts and fruit from the branches. Catcher-conveyors catch the nuts or fruit and transfer the produce to containers or holding tanks. Where it is necessary to harvest fruit by hand from tall trees, self-propelled, hydraulic orchard lifts equipped with a conveyor and a crating unit make up part of the lift equipment.

Vegetable or truck farm harvesters are used to gather such crops as cantaloupe, cabbage, lettuce, melons, and pineapple. The produce is picked by hand, and then is placed on a conveyor belt that extends over the rows. The belt elevates the produce into a tank, trailer, or truck. Machines have been developed that will harvest onions, carrots, cucumbers, radishes, grapes, tomatoes, berries, and other similar crops.

Hand Harvesting

Even though conveyor belt machines are used in the harvest of cantaloupe, lettuce, and cabbage, hand labor must be used. The same is true when using a tree shaker or hydraulic orchard lift. Some hand labor is needed for gathering fruit and nuts. The growing (producing) of fruit, nuts, and vegetables requires more hand labor than growing field crops. Some vegetables and fruit crops that require complete or limited hand harvesting are:

Cantaloupe	Broccoli	Oranges
Cucumbers	Cabbage	Lemons
Squash	Cauliflower	Grapefruit
Vine Beans	Lettuce	Plums
Peppers	Tomatoes	Pears
Eggplant	Radishes	Grapes
Okra	Melons	Peaches
		Apples

Another way to harvest a crop is to plow it under the soil. Legumes and some grasses are planted to improve the organic content of the soil. After a crop has reached the bloom or booting stage it is plowed under. It may be necessary to plow under a crop before it reaches maturity so the main crop can be planted on time during the spring. This method of harvesting a crop is practiced to improve the fertility of the soil.

SUGGESTED STUDENT ACTIVITIES

1. Complete the sentence by filling in the blank(s) with the correct word(s).

   a. Prior to about _____, approximately seventy-five percent of the total population lived on farms.
   b. When grain (wheat) was harvested by hand, about _____ man-hours were used to harvest one acre.
   c. A mechanical cotton picker removes the _____ cotton from the burr.
   d. The most modern type of cotton stripper is self-_____.
   e. Most hay is cut with a _____ mower.
   f. Ensiling is a method used to harvest _____ crops.
   g. The _____ type side delivery rake is most commonly used.
   h. Stack-wagon hay stacks may weigh over _____ pounds.
   i. During 1860 about _____ reapers were sold in the U. S. to harvest the grain crops.
   j. The most widely used harvesting machine today is the _____.

2. List ten very important crop harvesting machines.

   a. f.
   b. g.
   c. h.
   d. i.
   e. j.

3. Discuss the harvesting of grain before 1930.

4. Discuss the use of the combine.

5. Discuss the importance and use of the round hay baler.

6. Discuss the difference between the following kinds of machines:

   a. Standard rectangular baler and round hay baler.

   b. Side delivery and buck rakes.

   c. Cotton picker and cotton stripper.

   d. Cutter bar and rotary mower.

7. Select the appropriate word(s) for the statement below and write the correct word(s) in the blank space(s).

Platform auger	Rotating cylinder
Reel	Beater check flap
Cylinder beater	Grain pan
Shoe sieve	Cleaning fan

   a. Double action cleaning and final cleaning take place. _____ _____.
   b. Holds the plants against the guards until stems are cut. _____.
   c. Catches the grain separated at the concave cylinder beater grate. _____ _____.
   d. The grain is rubbed out of the head between concave grates and cylinder. _____ _____.
   e. Strips the cylinder and continues to separate loose kernels through finger grates. _____ _____.

f. Delivers cut grain to the feeder which carries it to the cylinder. _____ _____.
g. Regulates the flow of material over the racks. _____ _____ _____.
h. Supplies wind blasts which serve as medium of separation. _____ _____.

NOTES

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HANDLING, GRADING AND PACKING

The handling, grading, and packing of crops that are grown for food, feed, and fiber are controlled by many "Acts" and "Established Standards". Most standards protect the farmer, buyer, and consumer. The farmer or producer demands certain standards or guidelines when selling a commodity or produce from a crop. Industry also demands certain standards which will improve the marketing of its products. The public or consumer needs guidelines for buying a product. The exchange can involve quantity and quality.

Standards were first established by the Egyptians and Romans. The Egyptians invented the "standard" of length and the Romans developed a set of standards for weights and measures. These were minimum standards for trading in the market place. They differed from grade standards, in that they did not include the many characteristics which determined the actual quality of a product.

During the 12th Century Great Britain developed the "assize (ordinance) of bread", which became a factor for marketing food products. The bread ordinance established prices based on the contents and quality of the finished product. The early English Penny (Sterling) weighed "thirty-two Grains of Wheat, dry in the midst of the Ear". The best standard measures then known were the foot, hand, and grains of wheat.

Thomas Jefferson, who previously sponsored the decimal system of coinage, established the measure for a gallon (270 cubic inches) for dry and liquid matter.

The following Acts established standards and grades for most agricultural commodities:

The Cotton Futures Act - This Act was passed in 1914 and established the Department for Standardization of Cotton. The standards were made compulsory in the New York and New Orleans Cotton Exchange.

The Grain Standard Containers Act - This Act consists of a law passed by Congress standardizing 2-quart, 4-quart and 12-quart climax baskets. The standards included the dry quart and multiples of it for fruits and vegetables.

The Grain Standards Act - This Act established Federal standards for grain when sold through the interstate commerce agency.

The Food Production Act - This Act provided authority to establish standards and inspection services for vegetables and fruits and other food products.

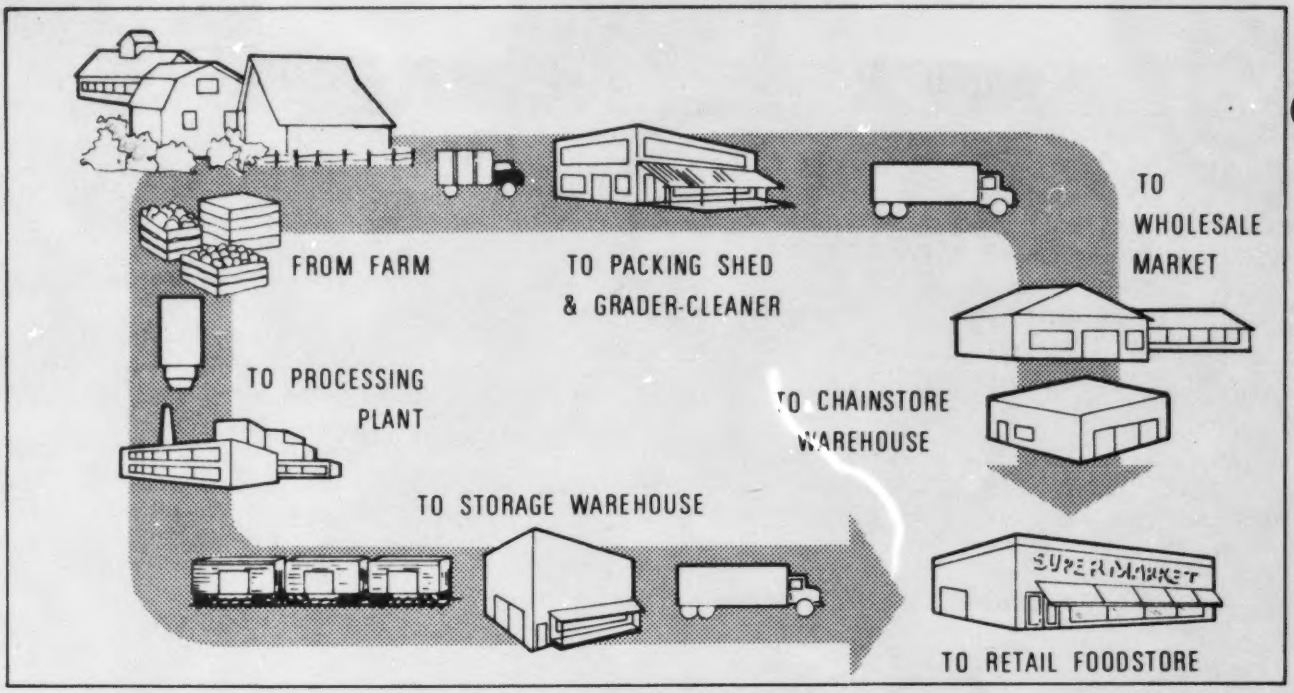
The Agricultural Marketing Act - This Act was established in 1946 to give the Secretary of Agriculture broad powers in developing and establishing standards for most farm commodities.

Many of these Acts have been amended to protect the producer, buyer, and consumer of crop produce. One of the major purposes of establishing standards in crop marketing is to eliminate abuse in the market place. Most standards which affect the quality of crop products are introduced through law. Actually, standards provide a foundation for our marketing system. When certain products are compared with a set of standards the products are grouped into grades.

Channeling From Producer to Consumer

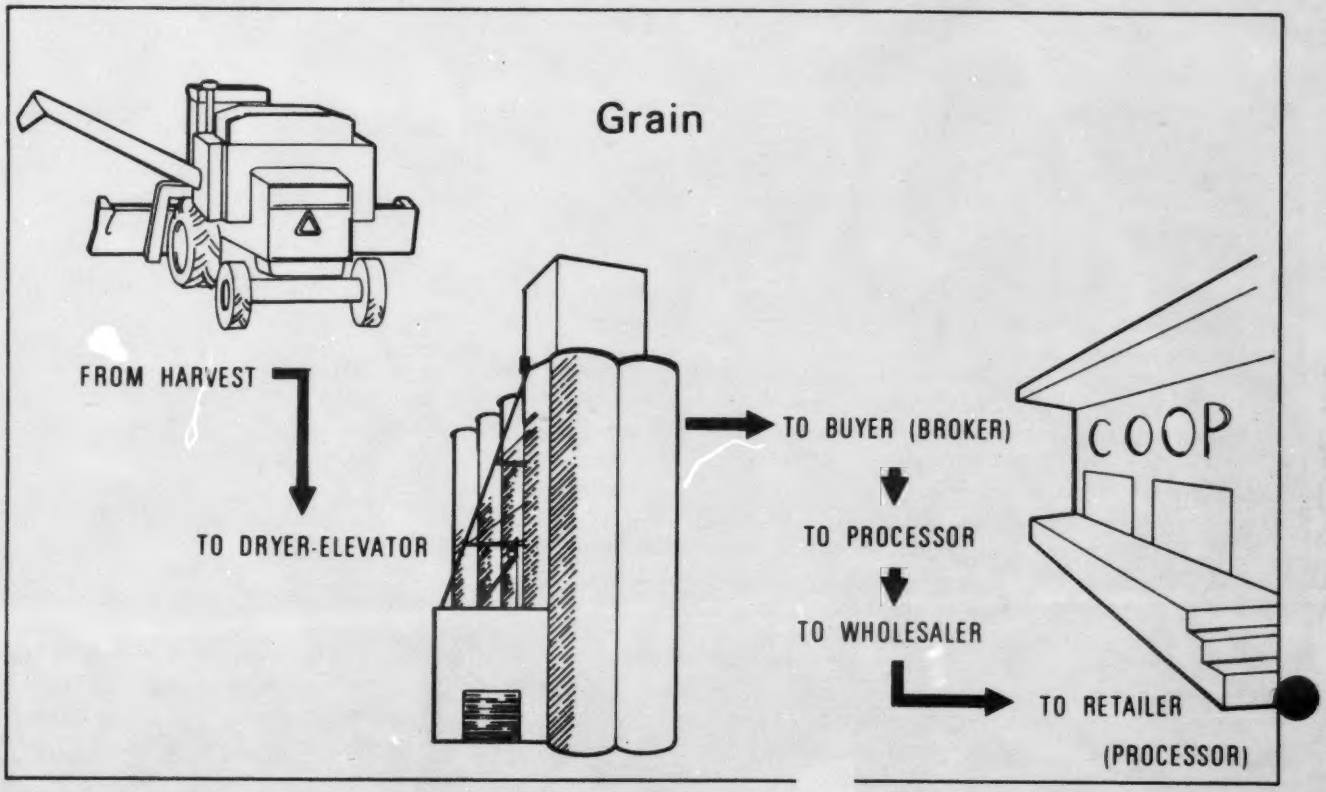
Many crops are harvested, graded, and packed entirely by machinery. However, there are still many crops (fruits and vegetables) that are harvested, graded, and packed or packaged by hand labor. One example of a crop being handled entirely by machinery is cereal or grain, except for sampling to record the grade and testing the moisture content. Usually after grain is combined, it is weighed, tested for moisture content, dumped in the elevator, sometimes sent through the dryer, removed from the elevator, and shipped to a buyer or processor. The processor delivers the product to a wholesaler, and the wholesaler sells to a retailer. As

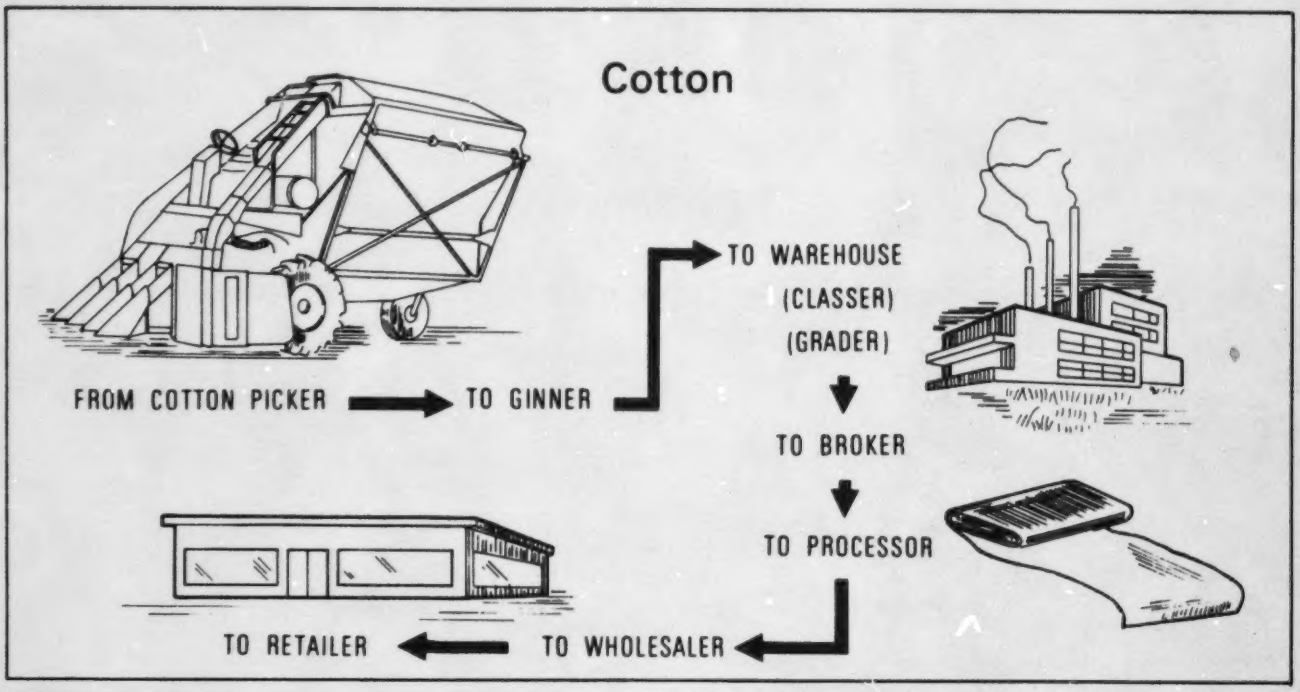
illustrated, many farm fruit and vegetable crops may take one of two routes to the retail foodstore:

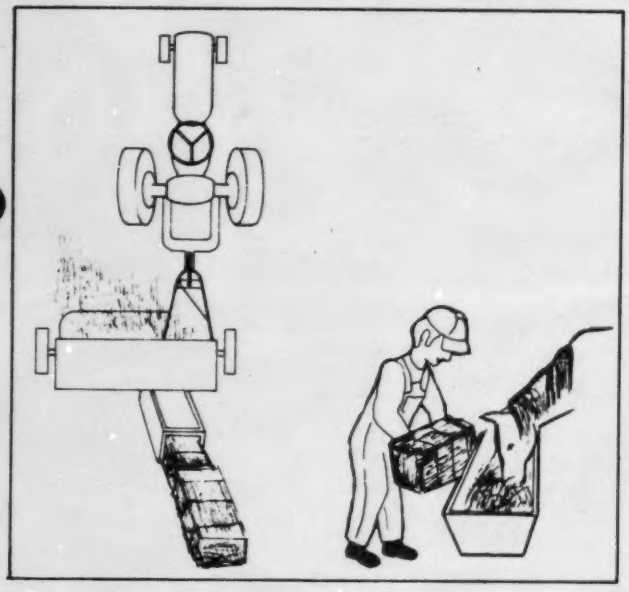


Each year improvements are made in mechanizing the handling of fruits and vegetables. Fruits and vegetables are considered perishable foods; therefore, special care must be practiced in order to preserve the product. Most vegetables and fruits require precooling after harvest. They must be packaged or crated in order not to disturb the tissue.

Grain and cotton routes from the farm to the retailer are as follows:







Hay is another crop that is handled almost entirely by machinery. There is one exception; most of the small rectangular bales are loaded in the field by hand onto a truck. However, automatic loaders are used to a limited degree even though several different types are available on the market. Baling methods have made a major change since 1970. In many areas of the state hay is being baled in round and large rectangular bales. Due to the size and weight of these bales, they must be handled entirely by machinery built especially for that purpose. The channeling of hay from the farm to the user is similar to other crops. For example, hay is cut, dried, and baled on the farm. It is also stored on the farm and transferred to a feeder for animal consumption. Small rectangular bales are stored under sheds or in barns to protect them from the weather. Large rectangular and round bales are stored in fenced-off open areas until they are fed to livestock.

Grading of Crop Products

Grading establishes a common language understood by the buyer and seller as a basis for judging the quality of a product in relation to its sales price. This forms a foundation for practically all transactions.

The quality of grain and cotton as well as most fruits and vegetables bought and sold in various commodity exchanges is designated in terms of federal grades.

The price received for a given commodity is not always determined by the grade. For example, some markets pay a premium for certain varieties of potatoes, apples, and peaches because of size, shape, or color.

Many factors affect the grades of grain crops, fiber crops, and fruits and vegetables. The following grading factors may be identified according to symbols for the major crop division affected: (Grain Crops G, Fiber Crops F, Fruit Crops FC, and Vegetable Crops V):

Proper size (G, F, FC, V)
Good natural color (G, F, FC, V)
Proper shade (G, F, FC, V)
Fleshy and firm (FC, V)
Free of decay (G, F, FC, V)
Free of sunscald (FC, V)
Free of foreign material (G, F, FC, V)
Free of insect damage (G, F, FC, V)
Free of disease damage (G, F, FC, V)
Free of bruises (FC, V)
Properly matured (G, F, FC, V)
Relatively free of moisture (G, F)
Free of damaged kernels (G)
Length and strength of fiber (F)

Most fruits and vegetables are graded U. S. Fancy, No. 1, No. 2, No. 3, Commercial, and Combination. The handling, grading, and packing of several fruit and vegetable crops are listed in Table No. 1.

Table No. 1 - Fruits and Vegetables

Crop	Handling	Grading	Packing
Snap Beans	Cool in bushel hampers	U. S. Fancy, No. 1, and No. 2	Field - 12 qt. to 50 baskets 1 to 2# packs and loose; mostly canned (bu. wt. is 28 to 30 lbs.)
Cabbage	Transferred from field in crates; sold by head	U. S. No. 1 and U. S. Commercial	Field - Crates and bags holding 50 to 80 pounds
Cantaloupes	Transferred to sheds for washing, waxing, and packing	U. S. No. 1 and U. S. Commercial Jumbo	Waxed and packed in crates Carton size - 18 to 45 melons
Carrots	Washed and cooled; precooled	U. S. No. 1 and U. S. Commercial	Packed in polyethylene bags, 48 bags to crate
Sweet Corn	Unloaded from field into bins for sorting; pre-cooled	U. S. Fancy, No. 1, and No. 2; According to size and fullness	Wirebound crates and polyethylene bags
Cucumbers	Transferred to sheds for washing and waxing; pre-cooled	Fancy No. 1, No. 2, and No. 3	Most are canned and not packaged. When packed, crates or cartons are used weighing 50 to 55 lbs. (1 bu.)
Lettuce	Packed in crates in the field; vacuum cooled	U. S. No. 1, No. 2, and Unclassified	Packed in small polyethylene bags and crated in fiber-board or wirebound boxes
Turnip and Mustard Greens	Cooled to near 32° F after packing in crates in field	U. S. No. 1 Commercial	Bushel basket or wirebound crates, 18 to 20 pound size
Onions	Transferred in bulk to packing house; precooled	U. S. No. 1, No. 2, and No. 3, Commercial Bermuda, Creole and Northern Grown	Cotton and paper mesh bags - 3 to 50 pounds

Potatoes	Transferred to storage or packing plant; unloaded by forks; dry brushed or washed before packing	U. S. Fancy, No. 1, Commercial and No. 2	Packed in 5, 10, 15, and 25 pound bags
Radishes	Shipped in crates and baskets; precooled	U. S. No. 1 and Commercial	12 and 16 quart crates hold 8 oz. film bags
Tomatoes	Transferred to packing house in bulk form; defects and color sorted by hand	U. S. No. 1, No. 2, No. 3 and U. S. Combination	Wooden flats holding 8 to 40 pounds
Grapefruit Lemons Oranges	Picking bags dumped into bulk; boxes delivered to packing plant; washing, degreening, waxing	U. S. Fancy No. 1, No. 2, No. 3, U. S. Combination	Polyethylene, fiber bags, wirebound crates, fiberboard boxes. Most lemons are shipped in fiberboard cartons containing 38 pounds
Peaches	Precooled if shipped a great distance from orchard	U. S. Fancy, Extra No. 1, No. 1, and No. 2	Cell cartons, fiberboard trays, bushel basket and half-bushel baskets
Strawberries	Transferred from field container to sale containers	U. S. No. 1 and No. 2 and U. S. Combination	Usually shipped in crates containing pint or quart tills or cups
Watermelons	If transferred from harvest, truck loaded by hand or bin to truck or freight car	U. S. No. 1, No. 2 and Commercial	Shipped in bulk or container holding up to 16 melons
Okra	Transferred from field after hand harvesting to shaded area	U. S. No. 1 and Damaged	Shipped in bushel baskets or cartons weighing 30 pounds or a lug weighing 18 pounds
Pears	Hand picked and transferred to packing area	U. S. No. 1, No. 2, U. S. Combination	Shipped in wooden and fiberboard boxes and baskets. Bushel weighs 47 to 54 pounds

Grain Grading -

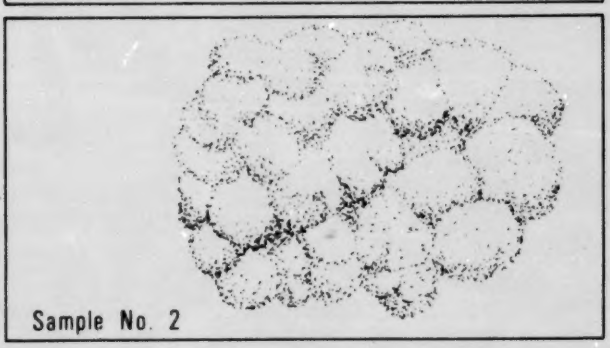
In order to inspect and grade grain properly, samples must be taken while the grain is on the truck, freight car, ship, and elevator. A probe (brass tube with slots) or trier is used to take samples on all carriers. A pelican (dipperlike device) is used to collect samples from elevator spouts. Several samples are collected in each carload to determine the quality and uniformity, then the samples are bulked together making up a specified amount for laboratory testing. This lab test gives the market class, dockage, and test weight. Other factors that affect the grade are soundness, cleanliness, purity of type, dryness, and general condition. An example of grading hard red spring wheat is as follows:

Grade No. 2 (Hard Red Spring Wheat)
57 (lbs.) 0.2% (heat damaged kernels) 4% (damaged kernels)
1.0% (foreign material) 5% shrunken and broken kernels)
5% (total defects) 1.0 contrasting classes) 5% (other wheat)
The test weight is the minimum limit, maximum limits for defects and other wheat classes.

Grain is graded similarly to fruits and vegetables in that No. 1 is considered the best grade. Grain increasingly inferior is given grades down to No. 5, and even Sample grade if the grain is too poor in quality to meet the requirements of number grades. Grain is not graded Fancy, Commercial, or Combination the way fruits and vegetables are done. However, there are standards that cover the marketing of mixed feed oats and mixed grain.

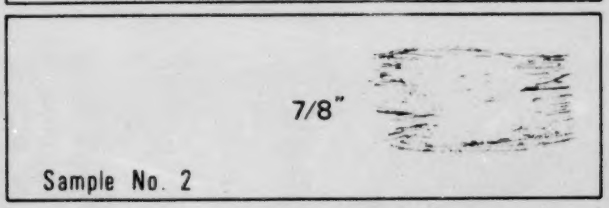
Two samples of corn are shown in the illustration. Sample No. 1 is uniform, free of foreign material, free of damaged kernels, and has no shrunken kernels. Sample No. 2 shows excessive amount of foreign material (leaves, parts of cobs, silks, and other types of trash). Many of the kernels are not uniform (round kernels), and there is an excessive amount of cracked and broken kernels. If foreign material is 7 percent and total damage is 15 percent, the corn will grade No. 5. Corn, like other grains, is classed as sample grade if defects exceed grade No. 5.

Cotton Grading -



The grading of cotton is known as classification of cotton. The classification of cotton is determined by two grading categories: cotton grade and cotton staple length and condition.

Grade is determined mainly by sight, taking into consideration three factors: color, foreign matter (leaf or trash), and fiber preparation. Sample No. 1 illustrates bright clean cotton whereas Sample No. 2 shows stained fibers containing foreign matter. Cotton harvested early in the season is usually a better grade than cotton harvested in late season (after January 1).



Staple is based upon the length of fiber of which two are illustrated. It can be determined by sight and touch. However, length can be measured by using a rule graduated in 1/16 ths. of an inch. Fibers are pulled out of a sample taken from a bale of ginned cotton and compared to an official staple length.

A prepared sample is also used by cotton graders to determine the color, foreign matter, and fiber preparation.

Even though fiber length uniformity and fiber strength

19

may be determined to a limited extent by a cotton classer, a more accurate measure may be made by using laboratory tests with special laboratory instruments. Uniform fiber length can be processed into stronger and better yarn. Naturally, a strong fiber makes a strong yarn. A strong fiber variety can be graded down due to weather exposure, excessive moisture, deterioration, improper ginning practices, and bacteriological action.

The fineness and maturity of fibers are other elements of character which can be determined by laboratory tests. Coarse fibers produce yarns with higher appearance grades and less waste in processing.

Sample No. 1 is a cross section view of coarse fibers, and Sample No. 2 is the same type of view of fine fibers. Micronaire (mike) readings or tests are made on cotton fibers to determine whether the fiber is classed very coarse, coarse, average, or fine. Textile mills are interested in an even-running mix of lint; therefore, the mike instrument is widely used in both domestic and international cotton trade.

Packing of Crop Products

The packing of crop products is larger than any other type of food packing industry. Large quantities of materials such as sawed wood, veneer, paper, paperboard, burlap, cotton, steel, glass, polyethylene, cellulose acetate, and aluminum foil are used to pack crop products.

There are many reasons for packing crop products. The most important ones are:

To protect the form and quality
To minimize damage from handling
To lessen the chances of contamination
Prevent the loss of moisture or protect the product from moisture
Improve the handling of certain products
Promote sales by making the product more attractive
Minimize enzymic and chemical changes
Improve the problem of storage and precooling

The different types of packing for shipment and sale are:

A. Wood crates reinforced with wire
B. Paperboard cartons, reinforced with corrugated paperboard
C. Cups or tills, made of wood or plastic
D. Burlap bagging and steel ties
E. Polyethylene bags
F. Bushel and one-half bushel baskets made of wood and wire
G. Burlap or paper sack
H. Paperboard crates with polyethylene trays
I. Polyethylene, cotton, jute, or twisted paper bags

Illustrations are on page 8.

Small grains are usually packaged in burlap or paper bags. Cotton is packaged in burlap and steel ties. Vegetables and fruits are packaged in the containers shown in the illustration.

The packaging technique is often complex. The steps in machine packaging when using cartons are:

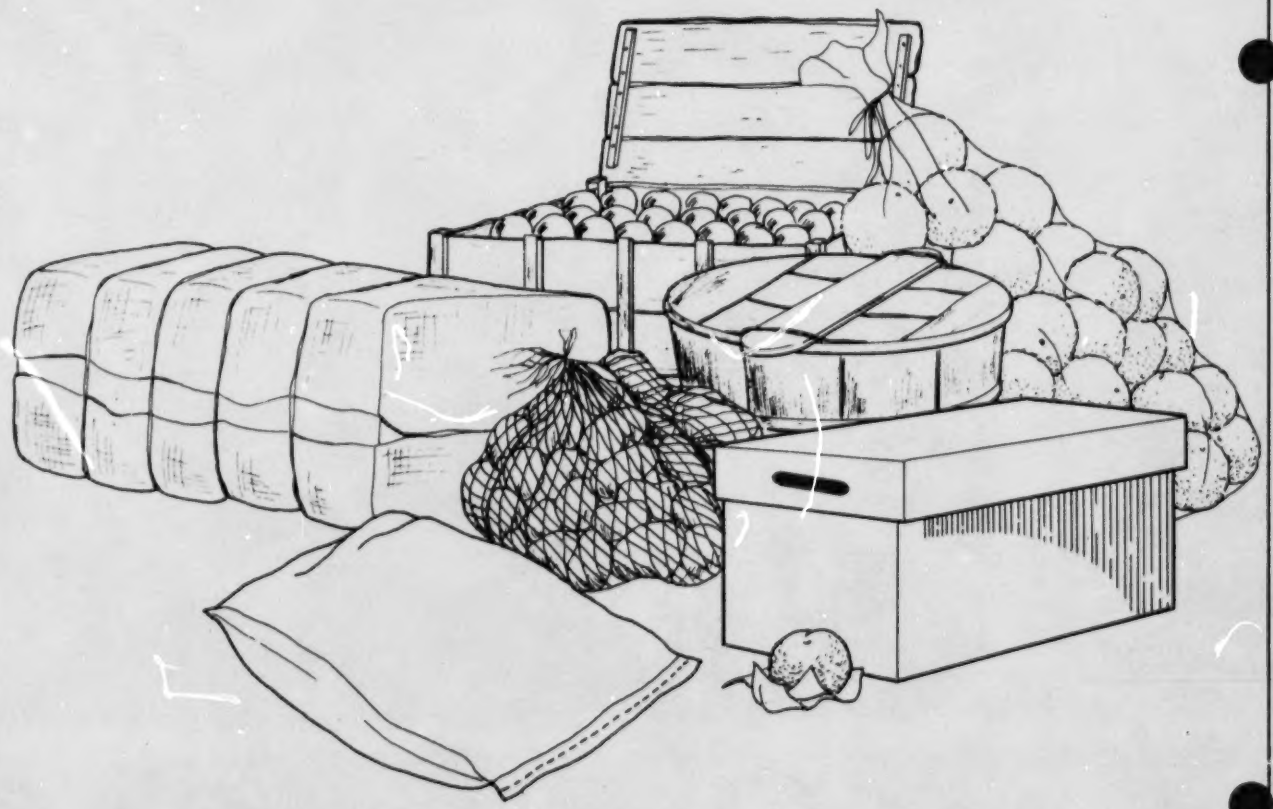
Flexible or semiflexible flat containers for packaging dry materials are fed into the machine.
The machine opens and sets up the cartons on a conveyor belt.
Uniform filling by machine is possible if the cartons are shaken during the filling operation.
Packages are weighed and rejected if improperly filled.
Acceptable packages are sealed and placed in shipping containers.

When bags are used for packaging crop products, they are machine-filled, weighed, tied or sewed, and stored or loaded. However, many (fruits and vegetables) are packaged in crates, baskets and tills by hand labor.

Most crop products are shipped by truck. However, about one third of the crop of some fruit and vegetable products are shipped by freight cars.

Usually, shipping by truck requires less handling, less expense and gives a more rapid service.

Packaging for Shipment and Sale



SUGGESTED STUDENT ACTIVITIES

1. Circle the T for true statements and the F for false statements.

F a. Standards regulating weights and measures were first established by the United States.
T F b. The bread ordinance developed by France in the 12th Century established prices on the contents and quality.
T F c. Wood crates reinforced with wire are used to package cotton lint (bales).
T F d. The Agricultural Marketing Act of 1946 permits the Secretary of Agriculture to set up standards for most farm crops.
T F e. Hay is handled almost entirely by machinery.
T F f. Grading of commodities protects only the consumer.
T F g. The price received for a given commodity is not always determined by the grade.
T F h. Most vegetable crops go from the farm directly to the wholesaler.
T F i. Hay baling methods have made a minor change since 1970.
T F j. There is less waste in processing a coarse cotton fiber than a fine fiber.

2. Fill in the blank by using the correct word(s) listed at the end of each statement.

a. The packing of crop products is _____ than any other type of food packing. Larger or smaller.
b. _____ fibers produce yarns with higher appearance grades. Fine or coarse.
c. Most crop products are shipped by _____. Railcar or truck.
d. Most fruits require _____ _____ after harvest. Little cooling or considerable cooling.
e. The price received for a given commodity is _____ determined by the grade. Sometimes or always.
f. Vegetables are graded _____ grade if they grade below the number grades. Sample or commercial.
g. Small grains are usually packaged in burlap or _____ _____. Wood crates or paper bags.
h. A _____ is used to catch samples of grain from the elevator spouts. Probe or pelican.
i. The quality of grain and cotton sold in various commodity exchanges is designated in terms of _____ _____. Commodity grades or federal grades.
j. The _____ invented the standard of length. Romans or Egyptians.

3. Discuss the following questions:

a. Purposes of establishing standards and what they provide.

b. How grain is channeled from the farm to the consumer.

c. The different types of packing for shipment and sale.

d. The steps used in machine packaging when using cartons.

e. Grade and staple as related to cotton.

4. Match the method of packing with the appropriate crop. Use recorded numbers.

( ) a. Lettuce
( ) b. Potatoes
( ) c. Lemons
( ) d. Onions
( ) e. Okra
( ) f. Strawberries
( ) g. Tomatoes
( ) h. Cantaloupes
( ) i. Sweet corn
( ) j. Cucumbers

(1) Waxed and packed in crates.
(2) Packed in wirebound crates and polyethylene bags.
(3) Packed in 5, 10, 15, and 25 pound bags.
(4) Wooden flats holding 8 to 40 pounds.
(5) Most are shipped in fiberboard cartons weighing 38 pounds.
(6) Shipped in bushel baskets or cartons weighing 30 pounds.
(7) Crates containing pint or quart tills.
(8) Cotton and paper mesh bags - 3 to 50 pounds.
(9) Packed in small polyethylene bags and crated in fiberboard boxes.
(10) Most are canned and not packaged.

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STUDENT MATERIALS

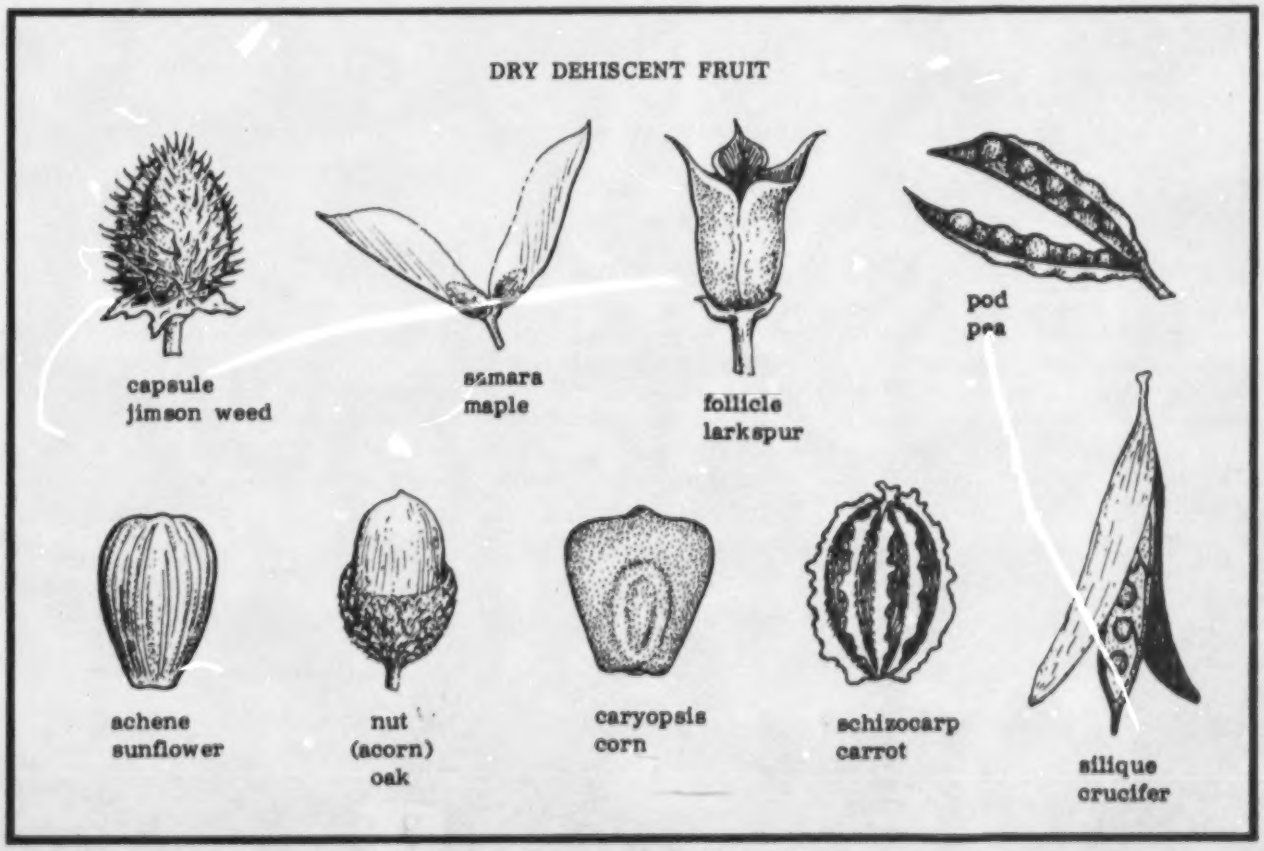
CLASSIFYING AND SELECTING FRUITS AND VEGETABLES

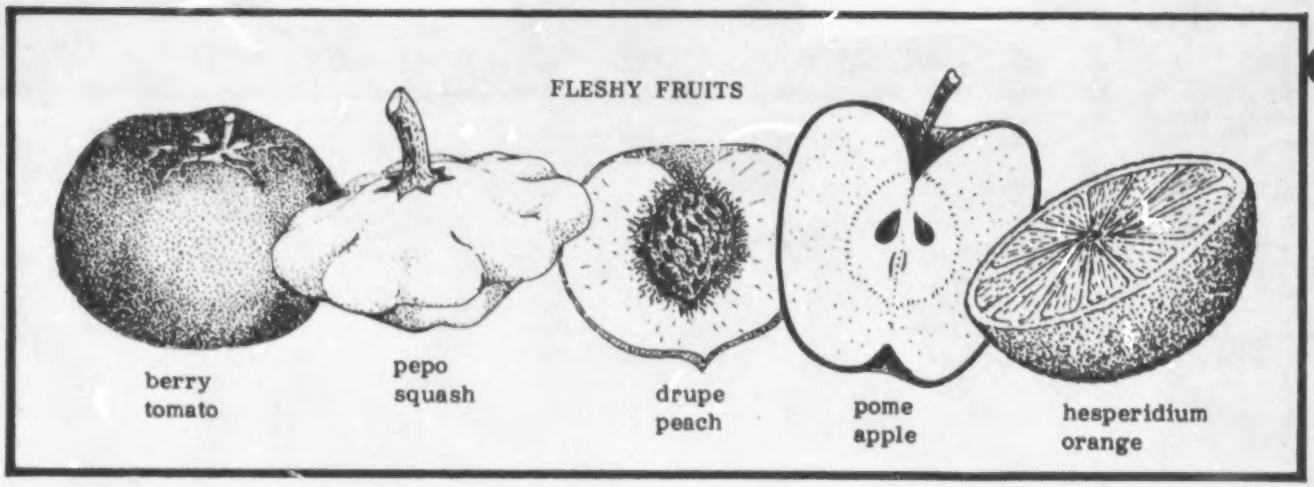
Pomology is the science and practice of fruit production. Olericulture is the science and practice of vegetable production. A general term that is used to identify the science of fruit, vegetable, and ornamental production is horticulture. It is the part of plant agriculture that deals with garden crops, whereas agronomy refers to field crops, mainly forages, grains, fiber and oil crops.

A fruit is defined as a mature ovary with its enclosed seed or seeds. The common usage of the word "fruit" refers to a crop product that contains a natural ovary which is usually sweet and pulpy. By using this common definition watermelons, grapes, avocados, and apples are fruits. Corn, tomatoes, pea and bean pods, cucumbers, eggplants, peppers, pumpkins, and squash are referred to as "vegetables"; however, these are ovaries or fruits. Fruits are considered a succulent food for man except nuts which are oil fruits. Most fruits are eaten as a snack, salad, or dessert. Most plants that produce fruits are usually classed as woody perennials. In the temperate zone, fruit plants are primarily deciduous; in the tropical zone, fruits are produced from evergreen plants.

Three different types of tissue are developed from the ripening of the ovary wall (pericarp). The thin outer skin is the exocarp; the fleshy inner tissue is the mesocarp; and the innermost tissue is known as the endocarp. Fruits are classified according to their structure. The number of ovaries and their location is also a factor in classifying fruits. These classifications are simple, aggregate, and multiple.

Simple fruits which consist of most flowering plants have a single ovary. If the pericarp of a simple fruit is fleshy it is referred to as a berry, which is one of the two major classes of fruits. A berry has no stony layers, but it has from a few to many seed. Some examples of simple fruits are illustrated as follows:





Other simple fruits include: grapefruit, lemon, grape, banana, watermelon, muskmelon, pear, cucumber, and pumpkin. These last five fruits are of the pepo family.

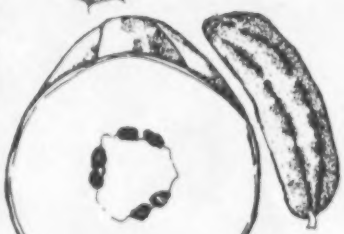
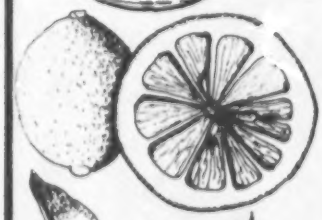
Aggregate fruits are borne from the same flower with many pistils on a single receptacle, forming a cluster. Blackberries and dewberries are classed as aggregate fruits and drupes. The receptacle is the edible portion of some of these fruits. Other fruits of the drupe class are known as "stone fruits". The fleshy exocarp is eaten, and the endocarp contains a single seed. Some examples of stone fruits are: plum, peach, almond, apricot, and cherry.

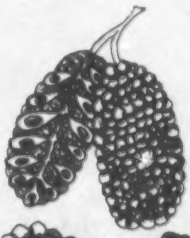
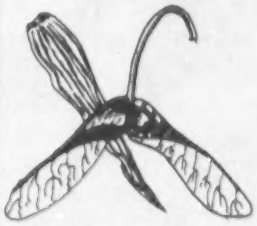
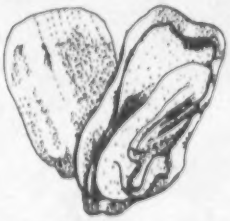
Multiple fruits make up the third class of fruits classified according to the number of ovaries found in the fruit. These fruits contain several ripened ovaries. They may be produced from many closely clustered flowers. Some examples include: mulberry, fig, and pineapple. Actually, the seed of a beet is a multiple fruit.

Both drupe and berry classes of fruits are considered the fleshy fruit group.

Dried fruits are grouped according to the number of seeds in the fruit. In this group of fruits the ovary wall (pericarp) becomes dry at maturity. The terms dehiscent (splits open at maturity) and indehiscent (fruit does not open) are used to identify dry fruits. Dehiscent fruits usually split open on reaching maturity. Examples include: pea, bean, milkweed, cotton, mustard, scarlet pimpernel, snapdragon, and peppergrass. Indehiscents may have definite seams similar to dehiscent fruits, but the seams do not rupture. Examples include: maize, wheat, oats, sunflower, ash, acorn, hazelnut, and buttercup. Another term used in identifying fruits is accessory fruits. These fruits are found mainly in the fleshy group, and some consist of a large amount of edible stem. The ovaries may be embedded or upon the stem and calyx tissues. The few pomes fit into this group.

SOME EXAMPLES OF FRUIT TYPES

FRUIT	TYPE	COMMON NAME
	Drupe	Plum
	Simple fruit berry	Tomato
	Pome	Apple
	Aggregate fruit achene	Strawberry
	Pepo	Cucumber
	Citrus, hesperidium, or berry	Lemon
	Legume	Bean

FRUIT	TYPE	COMMON NAME
	Aggregate fruit achene	Mulberry
	Multiple fruit achene	Dewberry
	Pyxis	Scarlet pimpernel
	Samara	Ash
	Caryopsis	Corn
	Follicle	Milkweed
	Silique	Mustard
	Silicle	Shepherd's purse

SOME EXAMPLES OF FRUIT TYPES (con't.)

FRUIT	TYPE	COMMON NAME	FRUIT	TYPE	COMMON NAME
	Capsule	Cotton		Nut	Pecan

Definition of A Vegetable and General Characteristics

If a vegetable is defined as the vegetative part of the plant, then it includes the leaves, stems, roots, and other parts that make up two or more parts of the plant structure. Vegetables can be defined as herbaceous plants that are eaten, either cooked or raw, by the individual and animal. All vegetables are classified in the Angiospermae division of plants. This means they have ovules in a carpel or ovary. They are grouped as monocotyledonnae (one seed leaf) or dicotyledonnae (having two seed leaves).

Vegetables Grouped According to Use

Vegetable families that are grown either for their stems, flower parts, or leaves:

Lily family (liliaceae)
chives, (allium schoenoprasum)
asparagus, (asparagus officinalis var. altilis)

Mustard family (cruciferae)
cabbage (brassica oleracea var. capitata)
brussels sprouts, (brassica oleracea var. gemmifera)
mustard, leaf (brassica juncea)
mustard, southern curled, (brassica juncea var. crispifolia)
turnip, seven top, (brassica rapa, var. septiceps)
sprouting broccoli, (brassica oleracea var. italica)
cauliflower, (brassica oleracea var. botrytis)
collard, (brassica oleracea var. acephala)
pak-choi. Chinese cabbage, (brassica chinensis)

Carpetweed family (aizoaceae)
New Zealand spinach (Tetratonia expansa)

Composite or Sunflower family (compositae)
artichoke, (cynara scoly mus.)
dandelion, (taraxacum officinale)
lettuce, (lactuca sativa)
chicory, (chichorium intybus)

Goosefoot family (chenopodiaceae)
beet, (beta, vulgaris)
chard, (beta, vulgaris var. cicla)
spinach, prickly-seeded (spinacia oleracea)
spinach, round-seeded (spinacia oleracea var. inermis)

Buckwheat family (polygonaceae)
spinach dock, (rumex patientia)
sorrel, (rumex acetosa)
rhubarb (rheum rhaponticum)

Valerian family (valerianaceae)
lamb's lettuce or corn salad, (valerianella locusta var. oliteria)

Ginseng family (araliaceae)
udo, (aralia cordata)

Parsley family (umbelliferae)
celery, (apium graveolens var. dulce)
parsley, (petroselinum hortense)

Vegetable families that are grown for either their seeds or fruits:

Grass family (gramineae)
sweet corn, (zea mays var. rugosa)

Mallow family
okra (gumbo), (hibiscus esculentus)

Gourd or melon family (cucurbitaceae)
bush pumpkin, (curcurbita pepo var. melopepo)
watermelon, (citrullus vulgaris)
pumpkin, (cucurbita pepo)
squash, (cucurbita maxima)
cucumber, (cucumis satiuus)
muskmelon, (cantaloupe), (cucumis helo.)

Parsley family (umbelliferae)
caraway, (carum carui)
dill (anethum graueolens)

Pulse or pea family (leguminosae)
yardlong bean, (vagna sesquipedalis)
broad bean, (vicia faba)
pea (English pea), (pisum satiuum)
peanut (underground fruits), (arachis hypogaea)
lima bean, (phaseolus limensis)
kidney bean (phaseolus vulgaris)
cowpea, (vigna sinensis)
soybean, (glycine max)

Nightshade family (solanaceae)
eggplant, (solanum melongena, var. esculentum)
tomato, (lycopersion esculentum var. commune)
pepper bell or sweet, (capsicum frutescens var. grossum)
ground cherry, husk tomato, (physalis pubescens)

Vegetable families that are grown for underground edible parts:

Goosefoot family (chenopodiaceae)
beet, (beta vulgaris)

Yam family (dioscroeaceae)
yam, (true), (diosco orea batatas)

Parsley family (umbelliferae)
carrot, (daucus carota var. satiua)
parsnip, (pastinaca satiua)
celeriac, (apium graveolens var. rapaceum)
hamberg parsley, (petroselinum hortense var. radicosum)

Morning glory family (convolvulaceae)
sweet potato, yam (erroneously), (ipomoea batatas)

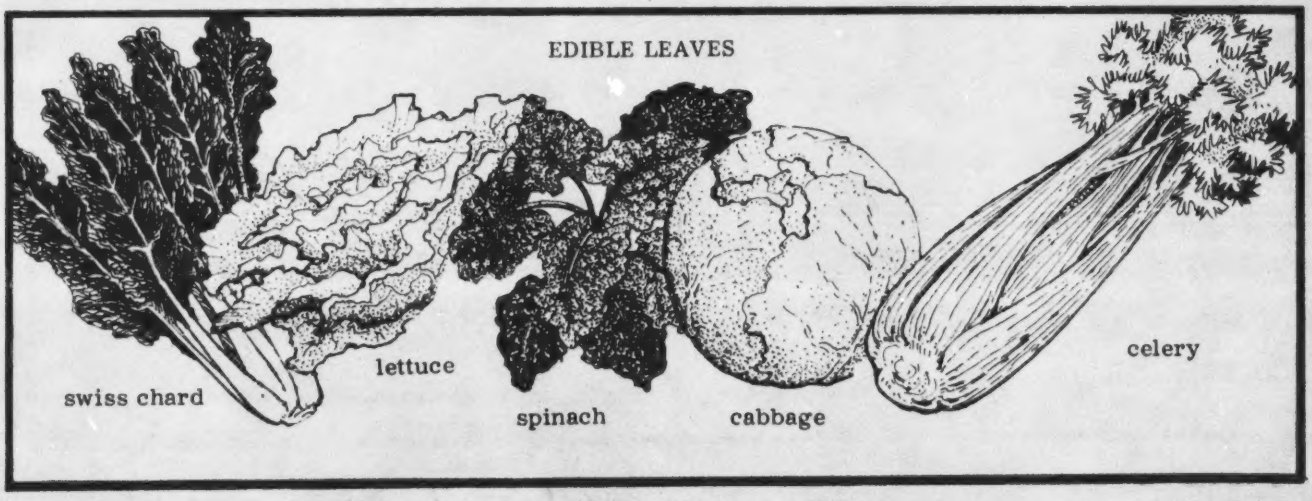
Composite or sunflower family (compositae)
black salsify, (scorzonera hispanica)

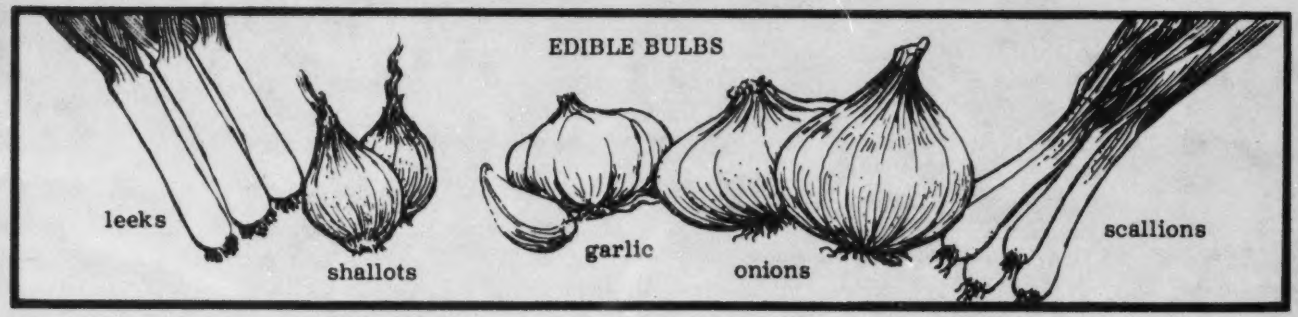
Nightshade family (solanaceae)
potato, (solanum tuberosum)

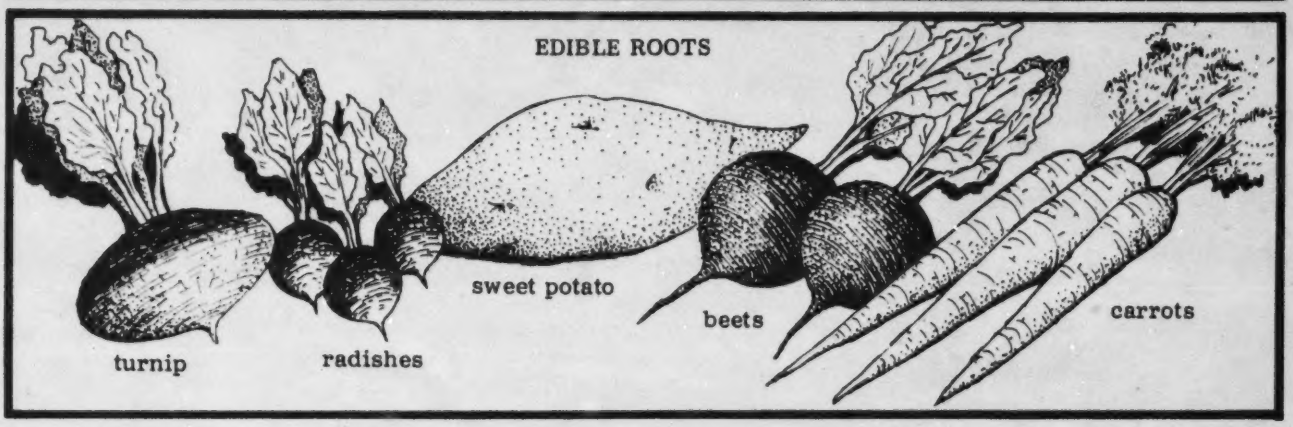
Mustard family (cruciferae)
horse-radish, (armoracin rusticana)
radish, (raphanus sativus)
rutabaga, (brassica napobrassica)
turnip, (brassica rapa)

Lily family (liliaceae)
garlic, (allium satiuum)
leek, (allium porrum)
onion, (allium cepa)
shallot, (allium ascalonicum)
Welsh onion, (allium fistulosum)

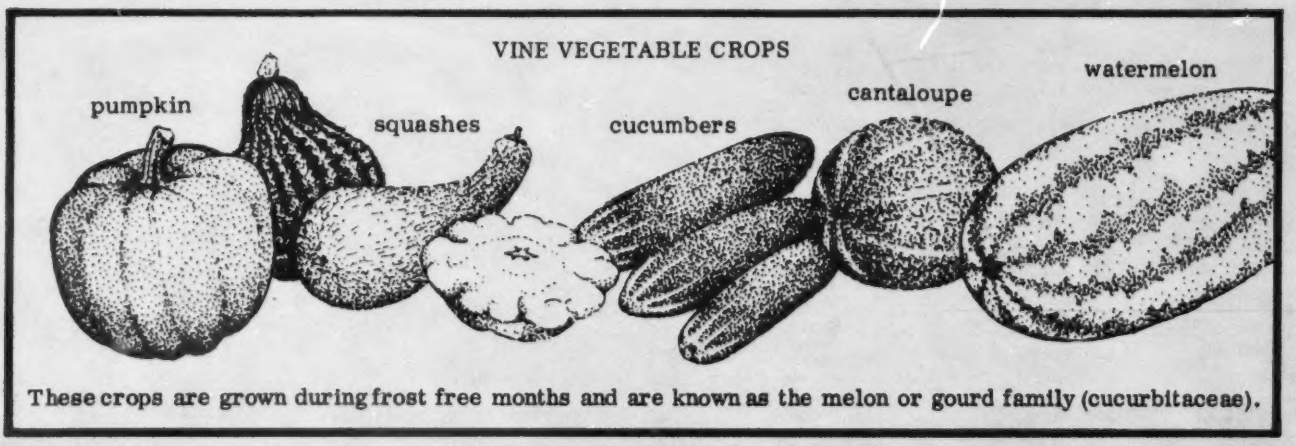
Some of the more widely used vegetables are illustrated in three groups according to the vegetable part used:



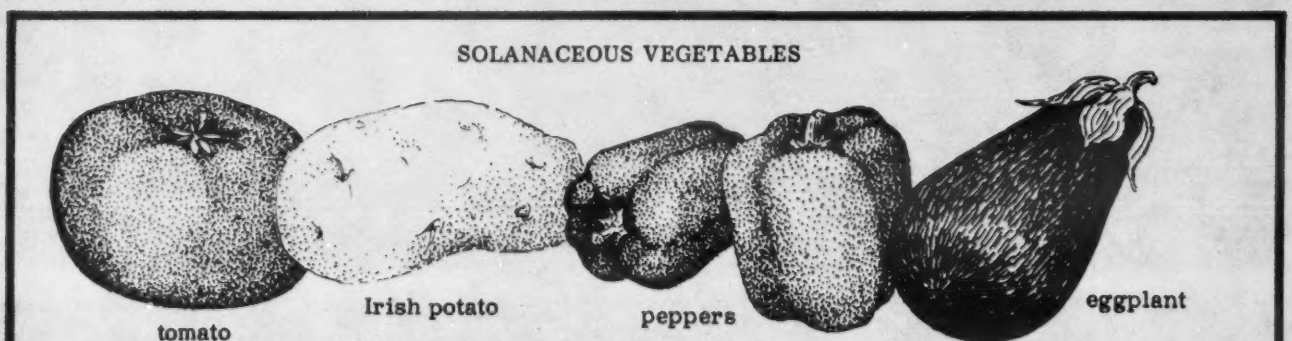




Some of the more widely used vegetables grouped according to common traits:

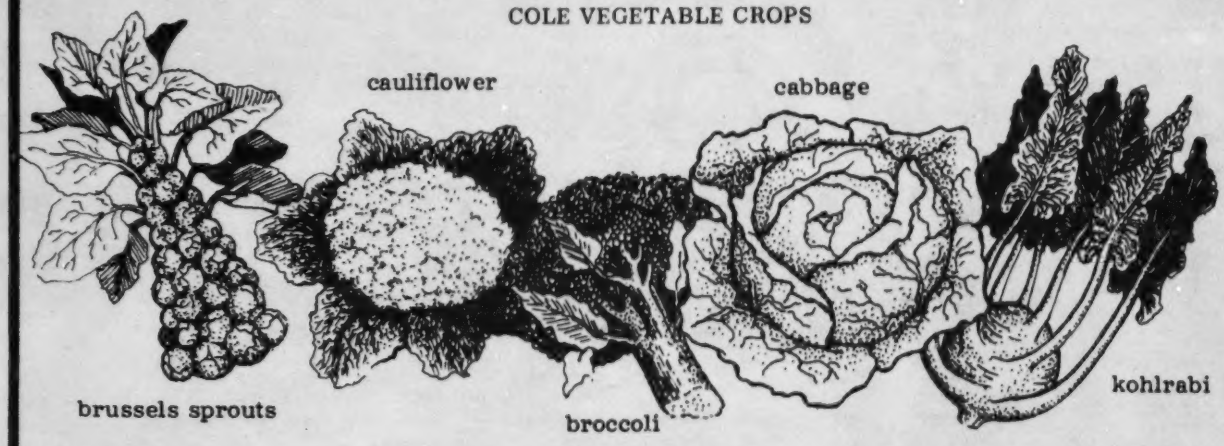


These crops are grown during frost free months and are known as the melon or gourd family (cucurbitaceae).



This family is known as nightshade (solanaceae), which includes the Irish potato.

COLE VEGETABLE CROPS



Cole crops are winter hardy and found in the mustard or cabbage families (crufiferae or brassicaceae).

Vegetables Classified According to Temperature Adaptation

Vegetables are further classified by their season of growth, either cool season or warm season plants. The cool season vegetable can withstand light frost or may endure freezing temperatures. This group of plants may be divided into those that can withstand frost and freezing temperatures and those that cannot survive freezing but can continue to grow in very cool weather. Such vegetables may be classed as half-hardy or hardy plants.

Plants that grow and do well in hot weather are called the warm season vegetables. Some of the warm season vegetables can withstand fairly cool weather and there are others that cannot tolerate cool weather.

General classification of vegetables according to their spring frost resistance.

WARM SEASON		COOL SEASON	
Very Tender	Tender	Half-hardy	Hardy
Pumpkin	Snap bean	Potato	Turnip
Pepper	Sweet corn	Lettuce	Rhubarb
Okra	New Zealand spinach	Chinese cabbage	Pea
Squash	Tomato	Celery	Radish
Sweet potato		Cauliflower	Onion
Watermelon		Carrot	Mustard
Cucumber		Parsnip	Horse-radish
Eggplant		Beet	Cabbage
Lima bean			Brussels sprouts
Muskmelon			Broccoli
			Spinach
			Parsley
			Asparagus

Plants may be divided according to season of growth as well as their use.

Warm season crops:

Crops not transplanted:		Transplanted:
snap beans	sweet corn	tomatoes
pumpkins	popcorn	eggplant
okra	lima beans	peppers
muskmelons	squash	
cucumbers		

Cool season crops:

Perennial crops:	Transplanted fall crops:	Spring crops:
globe artichoke	cabbage	cabbage
rhubarb	brussels sprouts	broccoli
asparagus	celery	celery
	cauliflower	head lettuce
	broccoli	leaf lettuce

Crops that withstand some summer heat:		Crops that reach quick maturity in spring and fall:
horse-radish	endive	radishes
parsley	carrots	mustard
potatoes	collards	leaf lettuce
New Zealand spinach	Swiss chard	peas
garlic	kale	kohlrabi
onions	beets	spinach
leeks	parsnip	

Relationship Between Fruit and Vegetable Crops

It is important to know the relationship between different fruit and vegetable crops. The growth habits of many types of fruits are similar as is the case of many vegetable crops. Cultural practices such as cultivation, fertilization, and insect and disease control methods may be the same or different among the various types of fruits and vegetables. However, selection is not made according to all of these characteristics of the many types of plants. The selection according to insect and disease resistant varieties is important if control practices are in doubt. Desirable characteristics that both fruit and vegetables must have are:

Adaptable to climatic conditions
Adaptable to soil conditions
Adaptable to local market conditions

SUGGESTED STUDENT ACTIVITIES

1. Match the appropriate words or phrases with the common terminology words.

a.	Pome ( )	(1)	Tomato
b.	Pod ( )	(2)	Corn
c.	Samara ( )	(3)	Squash
d.	Nut ( )	(4)	Apple
e.	Berry ( )	(5)	Jimson weed
f.	Drupe ( )	(6)	Pea
g.	Pepo ( )	(7)	Orange
h.	Hesperidium ( )	(8)	Peach
i.	Capsule ( )	(9)	Oak
j.	Caryopsis ( )	(10)	Maple

2. Completion

a. The thin outer layer skin on fruit is known as the _____.
b. _____ fruits are borne from the same flower with many pistils on a single receptacle.
c. Drupes are also called _____ _____.
d. _____ fruits contain several ripened ovaries.
e. Most plants that produce fruits are usually classed as woody _____.
f. _____ vegetable crops are grown during frost free months.
g. _____ crops are winter hardy.
h. _____ are considered a succulent food for man except _____ which are oil fruits.
i. The _____ _____ (vegetable crop) is a member of the nightshade family.
j. _____ fruits usually split open at the seams on reaching maturity.

3. Define the following terms:

a. Olericulture -

b. Indehiscent -

c. Pomology -

d. Horticulture -

e. Simple fruit -

f. Fruit -

g. Vegetable -

h. Cole crop -

i. Stone fruit -

j. Multiple fruit -

4. List a vegetable (common name) under each given family.

a. Parsley family

b. Grass family

c. Pulse family

d. Lily family

e. Nightshade family

f. Yam family

g. Gourd family

h. Mustard family

i. Mallow family

j. Goosefoot family

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CLASSIFYING AND SELECTING ORNAMENTAL PLANTS

Since primitive times the human being has categorized the surroundings as to living or nonliving, and in the case of living organisms, plant and animal. Ancient people were interested in the practical aspects of plants. They recognized plants that provided food, shelter, clothing, and fuel. However, during medieval times, some studies of plants were recorded in books called Herbals. Modern botany foundations began to be established during the seventeenth and eighteenth centuries.

The binomial system of plant classification is accepted internationally. A plant is usually identified by two names, the genus or generic name and the species or specific name. Latin was first used to identify organisms as early as the Middle Ages, and it is still the accepted language for this purpose. It is considered a dead language; therefore, it is unchanging to taxonomists over the entire universe. Many species of plants are subdivided into subspecies which are also written in Latin. When popular names are given to plants they are not Latinized.

Some Characteristics Used to Classify Ornamentals

Plant classification and relationship (taxonomy) and plant structure (morphology) were the first types of botany studies. These early types of studies did not require technical equipment and supplies. Today plants are classified on the basis of several different characteristics. Some of the most common ones are as follows:

Useful or Harmful - Plants were divided or in a way classed by the early user according to the way they could be used. There were certain plants used for food, fuel, equipment, tools, shelter, clothing, medicine, and transportation material. These plants still remain on the useful list for modern civilizations. The plants that could not be used (poisonous plants and weeds) were recognized as being harmful in early civilizations, and they are recognized in the same manner today.

Structural Form Characteristics - Plants may be classified as woody or herbaceous (succulent). Herbaceous seed plants with self-supporting stems are called herbs, while those that require support are called vines. Self-supporting woody plants are either trees or shrubs, the shrubs being characterized by having several upright stems while the trees usually have only one upright stem. Woody plants that require support for upright growth are called lianas.

Deciduous and Non-Deciduous - Plants that completely shed their leaves during the winter are known as deciduous plants. Some examples of deciduous trees are most oaks, willow, hackberry, Chinaberry, redbud, and mimosa. Non-deciduous (evergreens) keep their leaves the entire year. Some examples are juniper, pine, spruce, and live oak.

Life Span - Plants are classified on the basis of their life span.

Annuals are plants that normally complete their life cycle in one growing season. Some examples are peas, gourds, petunias, some phlox, zinnias, and snapdragons.
Biennials are plants that normally complete their life cycle in two growing seasons. Some examples are hollyhock, sweet william, and evening primrose.
Perennials are plants that grow from year to year and may take several seasons to reach maturity. The perennial does not die after flowering as do the annuals. Examples are oaks, pines, junipers, bulb plants, some vine plants, ferns, shrubs, tulips, and chrysanthemums.

Environmental Needs - Other classifications may be made on the basis of site preference such as desert or aquatic, sunny or shady, and acid or alkaline. Examples: Blackjack oak grows best in poor dry sites, and swamp chestnut oak of East Texas grows best in wet soil. There are many plants that are grown for their flowers, produced either in sunny conditions, shade, or part shade. Some of these plants are identified in the following illustrations.

SUNNY LOCATION

- ANNUALS -

African Daisy
Ageratum
Alyssum
Aster
Calendula
Candytuft
Celosia
Cleome
Cosmos
Dahlia
Hollyhock
Larkspur
Pansy
Phlox
Poppy
Portulaca
Sage
Snapdragon
Stock
Sweet Pea
Verbena
Zinnia

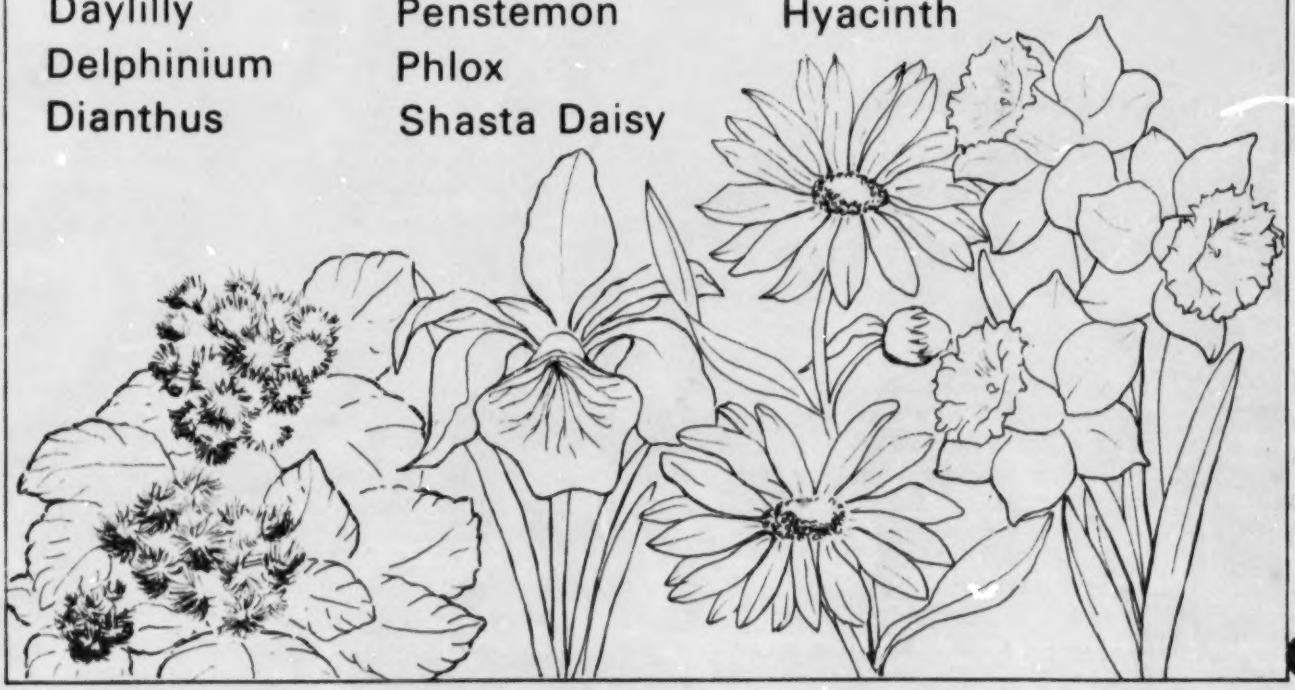
- PERENNIALS -

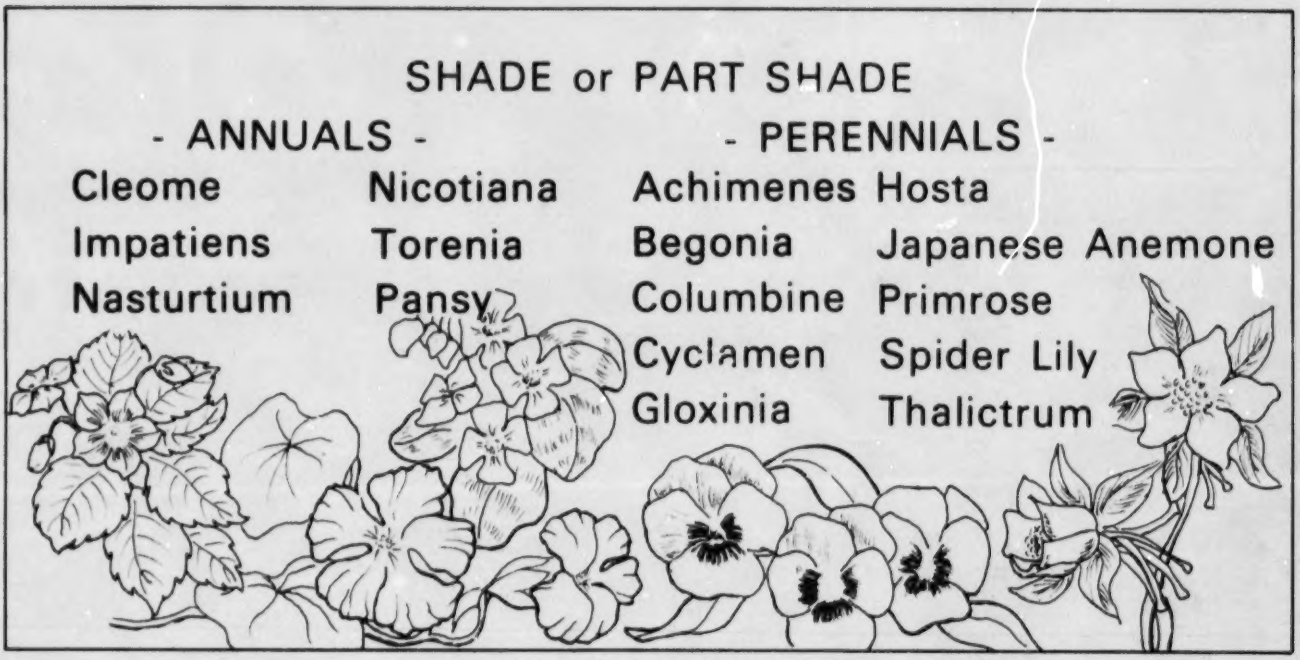
SEEDS

Achillia
Alyssum
Aster
Chrysanthemum
Coreopsis
Daylilly
Delphinium
Dianthus
English Daisy
Gaillardia
Gerbera
Michaelmas Daisy
Geranium
Penstemon
Phlox
Shasta Daisy

BULBS

Canna
Calla Lilly
Crocus
Dahlia
Gladiolus
Hyacinth
Iris
Lily
Narcissus
Ranunculus
Tulip





Tender and Hardy - Plants may be classified as tender if they cannot withstand low temperatures. They are referred to as cool season or warm season, depending upon the time of year during which they grow and bloom.

Morphological Characteristics - The most significant criteria used in plant classification are the structures of plant parts. This includes the root system, stems, leaves, flowers, fruit, and color of the plant. The morphological characteristic examination of the plant is the key to classifying it correctly.

Method of Reproduction - This is an important factor used in classifying plants. Many parts of the plant may be changed by environmental conditions, but the flower, fruit, and seed characteristics remain almost constant. Ornamental plants reproduce by sexual and asexual reproduction.

Another Criterion Used to Help Classify a Plant - Not all plants obtain food in the same way. For example, leguminous plants take nitrogen from the air and store it in the soil, whereas non-leguminous plants do not have this type of nitrogen-storing characteristic.

Scientific Classification of Ornamental Plants

The scientific classification is a method of dividing organisms first into small groups, on the basis of their similarities and differences. The first distinction is at the kingdom level. The taxonomic categories for climbing rose in the plant kingdom are:

Kingdom - Plant	
Division (Phylum) - Spermatophyta	
Class - Angiospermae	
Subclass - Dicotyledoneae	Major Taxa
Order - Rosales	
Family - Rosaceae	
Genus - Rosa	
Species - setigera	Minor Taxa
Variety - tomentosa	

Some examples of common names used to classify the climbing rose in the plant kingdom are as follows:

Spermatophyta - Seed plants

Angiospermae - Flowering plants
Dicotyledoneae - Dicots
Rosales - Rose order
Rosa - Rose
Setigera - Climbing rose
Tomentosa - A special climbing rose

These common names are listed above in the major and minor taxa. All categories from genus and below are listed in the minor taxa.

The angiosperm is the most important class of plants. There are over a quarter million species of angiosperms throughout the world. They are divided into two major classes, the monocotyledonae (monocots) and dicotyledonae (dicots). Angiosperms are usually considered broad leaved plants with seed enclosed in an ovary. They are the main source of food, clothing, shelter, and many other raw materials. Most of the flowering ornamental plants are in this class.

The second plant class of the division spermatophyta, the gymnosperms, include about 700 species of plants which are primarily evergreen trees. They provide lumber, lumber by-products, and ornamental plants.

Another vascular plant division is the pteridophyta or fern plants. Many fern species are considered ornamental plants.

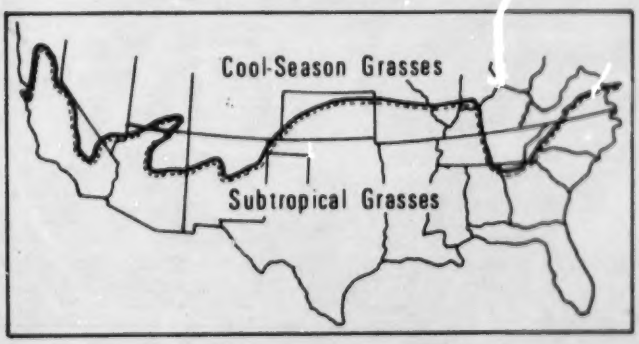
As one goes through the classification of organisms, the categories become more exclusive, and the organisms become more and more similar. Their differences have a tendency to be less obvious and more technical, but all plants have characteristics that cause them to be grouped in a certain order, family, genus, and species. For example, a common grass, bermuda grass, is placed in the order graminales and family gramineae because it has the following characteristics:

Its flowers are hidden in the chaffy bracts (leaf surrounding the flower) or reduced leaves.
Its fruit is either an achene or caryosis (a small dry one-seeded fruit).
Its flower is subtended by a lemma (lower bract) which closes both the flower and the palea (the upper bract).
The whole spikelet is subtended by two bractlets which do not enclose individual flowers.
Its stems are hollow and circular in cross sections.
Its leaf sheaths are not coalescent by the margins.

The gramineae family is made up of several genera. Genera are groups in which plants have several morphological (structural) similarities. They are further subdivided into species or variety groups that have many more morphological similarities than do the members of a genus. This family (graminae) is considered the most important of food plants because of the grain and forage production characteristics.

Major Divisions of Ornamental Plants

Ornamental plants are divided into two major classes, floricultural plants and nursery plants. Floricultural plants are generally herbaceous (succulent). They are grown for their blossoms and colorful leaves. Nursery plants usually include woody and herbaceous perennials. They are grown for landscaping purposes and can be classified according to their growth habits. Five of the major kinds of nursery plants are lawn or turf, ground covers not including grasses, shrubs, vines, and trees. A brief description and list of nursery plants is as follows:



Grasses or turf - These plants are usually classed as herbaceous perennials. There are some forty different types that can be used as lawn grasses. These grasses are adapted to certain regions (north and south) of the United States. Cool-season grasses are found in the northern region, and subtropical grasses are found in the southern region as illustrated.

The two groups of grasses are listed as follows:

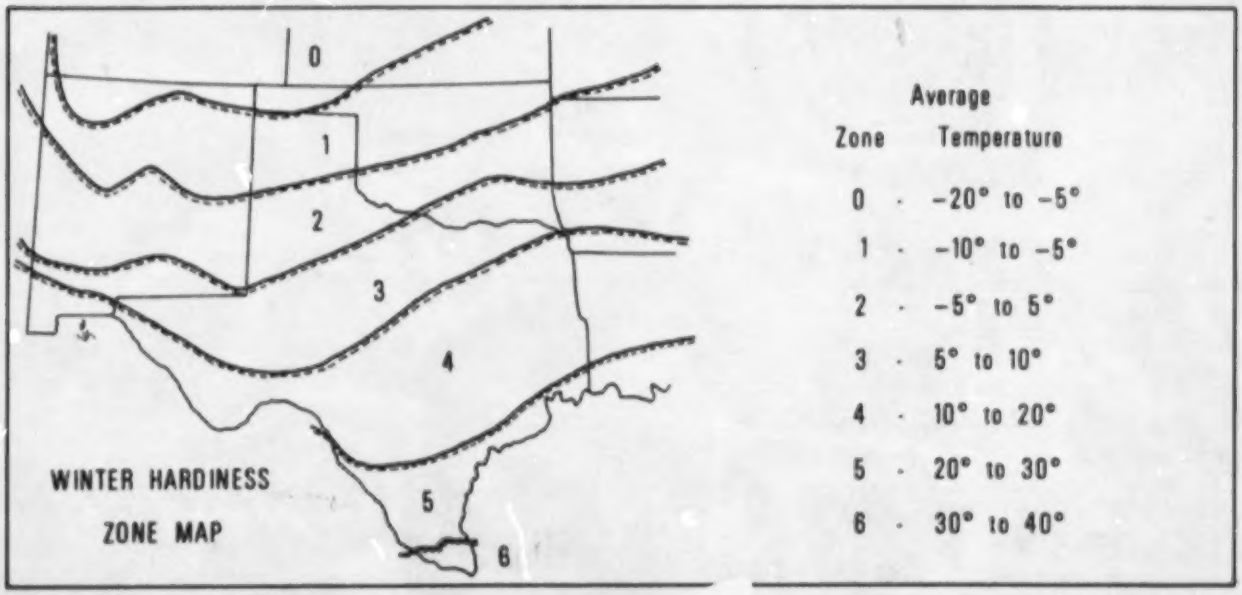
Cool-season	Subtropical
Bent grasses	Zoysia grasses
Fine fescues	St. Augustine grasses
Blue grasses	Bermuda grasses
Rye grasses (one annual)	
Redtop	
Coarse fescue	

Most of the major grasses in each group consist of several well known varieties. For example, bermuda varieties are common, tifway, tifgreen, ormond, U-3, T-35-A, tiffine, and sunturf.

Ground covers - There are more than one hundred different types of ground cover plants excluding grasses. Most ground covers are either herbaceous or woody perennials. They are similar to grasses, in that temperature and rainfall may greatly affect the adaptation of the plant. The majority of ground covers are considered hardy plants that will withstand sub-zero temperatures. However, there are a few plants which require temperatures above ten degrees Fahrenheit. Some ground cover plants that are commonly found in most states are:

Achillea Tomentosa - Woolly Yarrow
Ajuga Reptans - Carpet Bugle
Asperula Odorata - Sweet Woodruff
Bergenia Crassifolia - Winter Blooming Bergenia
Calluna Vulgaris - Scotch Heather
Campanula Carpatica - Tussock Bellflower
Cerastium Tomentosum - Snow-in-Summer
Ceratostigma Plumbaginoides - Blue Leadwort
Duchesnea Indica - Indian Mock Strawberry
Euonymus Fortunei - Winter Creeper
Hedera Helix - English Ivy
Hypericum Calycinum - Aaron's Beard
Juniperus Chinensis 'San Jose' - San Jose Juniper
Juniperus Horizontalis - Waukegan Juniper
Lantana Montevidensis - Trailing Lantana
Lonicera Japonica - Halls Japanese Honeysuckle
Mahonia Repens - Creeping Mahonia
Myosotis Scorpioides - True Forget-me-not
Nepeta Hederacea - Ground Ivy
Ophiopogon Japonicus - Mondo Grass
Phlox Subulata - Ground Pink
Pyracantha 'Santa Cruz' - Pyracantha
Saxifraga Sarmentosa - Yerba Buena
Trachelospermum Jasminoides - Star Jasmine
Vinca Major - Common Periwinkle

Shrubs - Many of the shrubs are considered to be deciduous (lose their leaves annually). However, some shrubs, such as junipers, are evergreens. There are thousands of ornamental plants classed as shrubs. They are similar to all other plants in that they are adapted to certain areas due to certain limiting factors such as temperature, rainfall, and soil conditions. The average minimum temperature is illustrated by zones on the map. There temperatures are as follows:



Plants may not grow normally if planted in zones where the temperature drops below the minimum recommended for the plant. This does not necessarily eliminate the plant's being grown in another zone at warmer temperatures, especially if moisture conditions are altered. Some of the more common shrubs are:

Abelia grandiflora - Glossy Abelia	(evergreen, Zone 1) Used as a larger hedge, screen, border, or accent plant.
Aucuba japonica - Japanese Aucuba	(evergreen, Zone 3) Used as an accent or, if large, as a background plant.
Berberis thunbergii - Japanese Barberry	(deciduous, Zone 0) Used as a hedge or accent plant.
Buxus sempervirens - Common Boxwood	(evergreen, Zone 1) Used as specimens, screens, or accents.
Cotoneaster horizontalis - Rockspray Cotoneaster	(deciduous semievergreen, Zone 0) Effective in rock gardens and as a filler plant.
Euonymus japonicus - Evergreen Euonymus	(evergreen, Zone 4) Used as a specimen shrub, sheared hedge, or undercover.
Ilex cornuta Burfordii - Burford Chinese Holly	(evergreen, Zone 3) Used as an informal hedge and as a specimen plant.
Juniperus Chinese Pfitzeriana - Pfitzer Juniper	(evergreen, Zone 0) Used as a border ground cover or base plant.
Lagerstroemia indica - Crape Myrtle	(deciduous, Zone 3)Used as deciduous screen or in place tree will not fit.
Ligustrum lucidum - Glossy Privet	(waxleaf, evergreen, Zone 3)Used as a specimen, screen or low windbreak hedge.
Nandina domestica - Heavenly Bamboo	(evergreen, Zone 3) Used as a corner or foundation planting and as a background or specimen shrub.
Pittosporum tobira - Green Pittosporum	(evergreen, Zone 4) Used as a hedge, barrier, screen, or accent plant.
Pyracantha coccinea - Scarlet Firethorn	(evergreen, Zone 2) Used as a colorful specimen plant or as an espalier at the wall.
Raphiolepis indica - Indian Hawthorn	(evergreen, Zone 3) Used in planter boxes and as a small hedge.
Thuja orientalis - Oriental Arborvitae	(evergreen, Zone 2) Used in areas requiring a large shrub.
Viburnum suspensum - Sandangus Viburnum	(evergreen, Zone 5) Used as a rugged hedge tolerating most adverse conditions.

Even though these shrubs are listed for a certain zone, most are found in that zone and south throughout the other zones.

Vines - Are both herbaceous and woody. They are also classed as evergreens, semievergreens, and deciduous plants. Vines are similar to shrubs and other ornamental plants, in that they are adapted to certain areas (zones) and when grown in the northern states they may appear to be completely deciduous. Yet, in the South they are evergreens. Some of the more common vines are:

Ampelopsis arborea - Peppervine	(semievergreen, Zone 3) Used mainly for ground cover and clinging to stone walls.
Bignonia capreolata - Crossvine	(evergreen, Zone 2) Used as a clinging vine.
Boussingaultia baselloides - Madeira Vine	(evergreen, Zone 5) Used as a clinging vine.
Campsis grandiflora - Trumpet Vine	(deciduous, Zone 3) Used as a flowering and climbing vine.
Cissus incisa - Marine-ivy	(semievergreen, Zone 4) Used as a clinging vine.
Clematis armandii - Armand Clematis	(evergreen, Zone 3) Used to produce flowers in shaded areas. Most species have colorful fruit.
Cobaea scandens - Cup and Saucer Vine	(evergreen, Zone 5) Used for its beautiful and long lasting spring and summer flowers.
Distictis lactiflora - Vanilla Distictus	(evergreen, Zone 5) Used to produce beautiful flowers.
Ficus pumila - Creeping Fig	(evergreen, Zone 5) Used to cover walls.
Gelsemium sempervirens - Carolina Yellow Jessamine	(evergreen, Zone 4) Used as a climbing vine and as a ground cover.
Hedera helix - English Ivy	(evergreen, Zone 2) Used to cover walls and to form hedges and ground covers.
Jasminum Mesnyi - Primrose Jasmine	(semievergreen, Zone 5) Used as a flowering vine and ground cover.
Jasminum officinale - Common White Jasmine	(semievergreen, Zone 3) Used as a semiclimbing shrub with fragrant flowers.
Lonicera hildebrandiana - Giant Honeysuckle	(evergreen, Zone 5) Used as a flowering vine and ground cover.
Muehlenbeckia complexa - Wirevine	(evergreen, Zone 2) Used to cover rocks, fences, and walls.
Parthenocissus heptaphylla - Sevenleaf Creeper	(deciduous, Zone 3) Used as a climbing vine on stone walls and trellises.
Passiflora caerulea - Bluecrown Passion-flower	(evergreen, Zone 4) Used as ground cover, for fragrant flowers and climbing vine.
Phaedranthus buccinatorius - Blood Trumpetvine	(evergreen, Zone 5) Used for screening purposes - covers large area in short time.
Schisandra propinqua - Himalayan Magnoliavine	(evergreen, Zone 4) Used as many other vines - twining and cover.
Smilax megalantha - Coral Greenbrier	(evergreen, Zone 3) Used as a climbing vine. Has lustrous foliage.
Trachelospermum asiaticum - Yellow Star-jasmine	(evergreen, Zone 3) Used as a twining vine with fragrant flowers - makes screen.

Wisteria macrostachya - Kentucky Wisteria	(deciduous, Zone 2) Used as late blooming twining vine, usually planted to cover porches and arbors.

There are about 1,100 species of native trees found in the United States and more than half of these are in the southern states. Texas alone has some 200 species that are native plants. Many exotic species have been added during the last century.

Trees are identified by several general terms. Some of the more common terms are:

Cone-bearing or needle-bearing trees - These trees are generally classed as softwood trees and are also known as conifers. The term non-deciduous (evergreens) is used to identify this group of trees.

Broad-leaf or hardwood trees are usually considered deciduous (shed their leaves in autumn). However, live oak, southern magnolia, and American holly do not shed.

Trees are the same as other plants in that they prosper better in certain areas of the state due to ideal temperature, rainfall, altitude, and soil type conditions. The hardiness zone map used for shrubs may also be used to determine where certain trees grow best in the state. Some of the more common ornamental tree type plants are listed below by genus, species, and common name. The area in which they may be better adapted and the uses of most of the trees are also listed. These plants are as follows:

Albizia julibrissin - Mimosa or Silktree	(deciduous, Zone 3) Used as a specimen tree, yet is considered a trashy tree.
Carya illinoensis - Pecan	(deciduous, Zone 1 south) Used as shade trees and nut production.
Cedrus deodara - Deodar Cedar	(evergreen, Zone 3) Used as a large specimen tree.
Pinus taeda - Loblolly Pine	(evergreen, East Texas) Used as a specimen tree and building material.
Taxodium distichum - Baldcypress	(deciduous, East Texas) Used as a specimen tree and building material.
Fraxinus velutina - Arizona Ash	(deciduous, Zone 5) Used as a street tree or shade tree.
Cupressus empervirens - Columnar Italian Cypress	(evergreen, Zone 3) Used along boulevards or to frame views where a strong vertical line is needed.
Gleditsia triacanthos inermis - Thornless Honeylocust	(deciduous, Zone 0 south) Used as a tall barrier hedge when young.
Magnolia grandiflora - Southern Magnolia	(evergreen, Zone 3 east) Used as a large specimen tree in areas with adequate soil, moisture, and space.
Liquidambar styraciflua - Sweetgum	(deciduous, Zone 5 south and east) Used as a shade and specimen tree.
Malus species cv - Flowering Crabapple	(deciduous, Zone 1 south) Used as a small flowering specimen tree.
Pistacia chinensis - Chinese Pistache	(deciduous, Zone 5) Used as a shade tree and colorful plant in fall.
Platanus occidentalis - American Plane Tree (Sycamore)	(deciduous, Zone 3 south) Used as a shade tree, street tree, or specimen tree in areas with ample space.
Podocarpus macrophylla - Yew Podocarpus	(evergreen, Zone 3 south) Used as a small tree, hedge,

	or even shrub.
Populus deltoides - Cottonwood	(deciduous, Zone 3 south) Used as a specimen and street tree.
Prunus caroliniana - Carolina Cherry Laurel	(evergreen, Zone 4 south) Used as a specimen tree or as a natural hedge.
Quercus virginiana - Live Oak	(evergreen, Zone 3 south) Used as a spectacular shade tree.
Quercus falcata - Spanish or Southern Red Oak	(deciduous, Zone 3 south) Used for landscape planting where large trees are needed.
Quercus Nigra - Water Oak	(deciduous, Zone 3 south) Used as a shade and street tree.
Quercus palustris - Pin Oak	(deciduous, Zone 1 south) Used as a specimen and lawn tree.
Quercus shumardii - Shumard Oak	(deciduous, Zone 1 south) Used for large shade or specimen tree.
Ulmus americana - American Elm	(deciduous, Zone 0 south) Used as a large shade tree and lawn specimen.
Ulmus parvifolia - Chinese Elm	(deciduous, Zone 5 south) Used as an outstanding tree for landscape, permanent screen, and windbreak plant.
Sapium sebiferum - Chinese Tallow	(deciduous, Zone 5) Used for landscaping in lawn areas.
Morus rubra - Red or American Mulberry	(deciduous, Zone 0 south) Used for shade and specimen tree.
Celtis occidentalis - Common Hackberry	(deciduous, Zone 0 south) Used for street and lawn planting.
Cornus florida - Flowering Dogwood	(deciduous, Zone 0 south) Used as a small plant to add color during blooming stage.
Fraxinus velutina galbra - Modesto Ash	(deciduous, Zone 3) Used as a street and lawn tree.

An Explanation of the Factors That Affect the Selection of Ornamental Plants

Naturally, climatic condition is a very important factor to consider when selecting plants. This involves temperature, rainfall, and wind.

Temperature - First of all, the United States is divided into several temperature regions. Texas alone has five different temperature zones with a minimum temperature range from a minus 10° F to a maximum temperature in each zone of over 100° F. These minimum and maximum temperatures must be taken into consideration when ornamental plants are being selected. For example, tender plants must have protection during cold periods; therefore, one would not want to select a plant that requires extra care for planting during the winter months. Plants vary in their adaption to the variation of temperature.

Rainfall - There are several rainfall regions in the United States and Texas. Some parts of East Texas receive over 40 inches of rainfall annually, whereas other parts receive below 15 inches annually. A plant that requires a high amount of water in an area of low rainfall must be furnished water artificially, and if they are grown around homes they are more often over-watered than under-watered. However, different plants vary in the amount of water needed for growth and maintenance.

Wind - This is another climatic factor to consider when selecting plants; that is, if high wind velocity is a problem in the area. Wind combined with either soil movement or excessive moisture can be a serious problem. Usually tall plants with a tap root system will withstand more wind than plants with a fibrous root system. In most areas wind is not considered a problem for outside ornamental plant production.

Another important factor is soil conditions.

Soil pH - The pH of a soil is the degree of acidity or alkalinity on a scale from 0 to 14. A neutral soil is 7. Any number above 7 is alkaline and below 7 is acid. Some plants require acid soils, whereas others require alkaline soils. The pH may be affected by soil depth and moisture in the soil. For example, a soil that is continually moist or wet is likely to be acid. This is the reason that good drainage is important. Some grass plants grow best in a neutral soil. Instead of trying to locate a grass plant that will grow in an acid soil, it is considered best to lime the soil to make it more neutral.

Soil Depth - The top layer of a soil supplies nutrients for plants in the development stages. The ideal soil must contain the proper amount of moisture, all the essential elements, adequate organic matter and proper amounts of air. The subsoil which is below the main root system holds the moisture so that it can be used in the vacancy of the top soil.

Soil Physical Properties - In order for a soil to be in good physical condition for plant growth and maintenance, the solid particles must be in the right proportions. The particles must be open in order to permit moisture to enter, yet close enough to retain the moisture and open enough to be well aerated so plant roots can receive adequate oxygen. Two terms that are used frequently to describe physical properties are as follows:

Soil Texture - This term refers to the amount of sand, silt, and clay in a soil. For example, a soil containing 65 percent sand, 25 percent silt, and 10 percent clay is classed as sandy loam. If a soil contains 25 percent sand, 65 percent silt, and 10 percent clay, it is classed as a silt loam.

Soil Structure - This term is used to identify how the particles are grouped together to form aggregates. The property of infiltration of water is greatly influenced by structure. Granular and single grain soils permit rapid infiltration of water, blocky and prismatic soils take in moisture moderately fast, and massive and platy soils (particles stick together) take in water very slowly.

All soil factors must be considered when selecting plants. Even though most plants will do better on rich soils, some will tolerate soils that are classed infertile. The texture and structure of a soil are also factors to consider when selecting plants. For example, there are turf grasses that grow more rapidly on loose or granular soils than on tight, clay type soils. Yet, there are grasses adapted to the clay loam soils.

An important factor that is overlooked many times when selecting ornamental plants is light requirements. Some plants require full sunlight for maximum growth, while others require varying amounts of shade and sun. Plants that require full sunlight should not be selected for planting in an area of filtered light or partial shade. Plants that require partial shade should be planted where the light is filtered, such as an area under trees, eaves of buildings, under light filtering material, and in greenhouses.

Growth form affects selection. A sprawling type juniper does not grow into an upright tree. Also, a spreading, long-limbed tree such as a mimosa should not be planted near a permanent flower bed or too close to a wall or similar structure; therefore, plant form is a very important factor to consider when selecting plants. Some of the main tree forms are:

Rounded	Ovate	Truncate
Columnar	Oblong	Broad-ovate
Pyramidal	Obovate	Picturesque
Weeping	Lanceolate	Globose

Proper landscaping procedures should be followed when placing short (dwarf), medium, and tall plants. The size of plants is certainly a factor in selecting shrubs or in selecting flowering plants (annuals and perennials) for flower beds. Tall plants are planted near walls or at the back of shorter plants. In patio or center flower gardens, tall plants are planted in the center of the arrangement in order not to hide the shorter plants.

Rate of growth is a factor in selecting shade trees. Many homesites are treeless. It might be best if a few fast-growing species are planted in addition to the "favorite" trees which may be slow growers. Some fast growing and slow growing trees are as follows:

Fast growing	Slow growing
Chinaberry	Ash
Chinese Tallow	Juniper
Cottonwood	Oak
Mimosa	Magnolia
Pine	Sweetgum
Sycamore	
Willow	

Ornamental plants may be selected according to blooming dates. Some landscapes have beautiful flowers during one season of the year, but are relatively barren during the remainder of the year. The approximate blooming dates should be checked in order to utilize several different varieties that will produce blooming plants in the garden year round.

Another very important factor that must be observed when selecting plants is the amount and intensity of care that certain species require. Many good ornamental plants are relatively simple and easy to care for, while others require more complex and intensive care. One must allow for considerable time and money to be devoted to the maintenance of plants whose size or growth form do not fit the location and use for which they were planted. It is usually better to select the right plant for the job than to have to force the wrong plant into an acceptable shape so it will fit the use desired.

Trees may be selected for their unusual bark color. Some trees are especially attractive during the winter months. Trees with attractive bark are: Hackberry, magnolia, sycamore, cottonwood, white oak, white poplar, and yellowwood. Some trees are selected according to the color of foliage at certain seasons. For example, purple foliage appears on white ash and white oak; red leaves appear on dogwood; sassafras has orange leaves; and yellow foliage may appear on hickory, oak, poplar, linden, elm, ash, and redbud. Most trees are expected to live between 50 and 100 years; therefore, useful life is not a factor in selecting a tree.

Some undesirable characteristics to be considered when selecting a tree are:

The American elm is susceptible to the Dutch elm disease.
Pecan and thornless honeylocust are subject to attack by certain types of webworms.
Mulberry and female ginkgo are considered garbage trees in many localities due to the fruit they produce.
Cottonwood sheds leaves the entire year in semiarid regions.
Sweetgum fruits-gum balls- are a nuisance in lawns.
Elm, willow, and poplar are notorious sewer cloggers.
Poplars and mimosa produce seed that sprout in the lawn and flower bed.
Pines shed needles during dry seasons.

The problem of selecting shrubs equals that of selecting desirable trees. Most shrubs are selected for the following reasons:

To accent the lines of a building.
To beautify an area with colorful flowers, berries, or foliage.
To screen a particular view.
To serve as borders for drives, walks, and boundary lines.

There are several factors that should be considered when selecting shrubs. Some of the most important factors are: The size of plant desired; soil conditions; type of foliage, color and condition all seasons; maintenance blends with surroundings. Most shrubs can use some shade.

The following plants vary in their requirements for light, some needing complete shade and others needing full sunlight.

American Arbor-Vitae - This shrub will tolerate some shade.
Yews - It will tolerate partial to full shade.
Japanese aucuba - This plant does best in light to full shade.
Arrowwood - This plant will grow in any kind of shade.
Japanese andromeda - This particular plant requires only light shade.

Camellia - Camellia is a very popular plant for planting in light to open shade.
Dogwood - Gray dogwood should be planted in light to half shade.
Japanese holly - This plant will tolerate dense shade.
English Ivy, mountain-laurel, periwinkle, and rhododendron require open shade.

NOTES

SUGGESTED STUDENT ACTIVITIES

1. Fill in the blanks indicated below to make true complete statements:

   a. The _____ is the most important class of plants.
   b. Two major classes of ornamental plants are _____ and _____.
   c. A plant that sheds its leaves in the fall is known as _____.
   d. A plant is usually identified by two terms, the _____ and _____.
   e. Plants that normally complete their life cycle in two growing seasons are referred to as _____.
   f. Ornamental plants reproduce by sexual and _____ reproduction.
   g. The most significant criteria used in plant classification are the structures of plant _____.
   h. Angiosperms are usually considered _____ leaved plants.
   i. The minimum temperature in zone 6 is between _____ and _____ degrees F.
   j. There are more than one _____ different types of ground covers.

2 Insert the appropriate word(s) in the blank spaces to make complete and correct statements.

   a. Soil texture
   b. Thousands
   c. Seven
   d. Setigera
   e. Six
   f. Soil structure
   g. Spermatophyta
   h. Ground covers
   i. 1,100
   j. Gramineae

   (1) Most _____ are either herbaceous or woody perennials.
   (2) The species term used to identify the wild climbing rose is _____.
   (3) All grasses are in the _____ family.
   (4) There are about _____ species of native trees found in the United States.
   (5) There are _____ of ornamental plants classed as shrubs.
   (6) The amount of sand, silt, and clay in a soil determines the _____.
   (7) A neutral soil has a pH of _____.
   (8) Texas is divided into _____ average minimum temperature zones.
   (9) _____ refers to how the soil particles are grouped together to form aggregates.
   (10) Seed plants are in the _____ plant division.

3. Define the following terms:

   a. Annual -

   b. Perennial -

   c. Non-deciduous -

   d. Taxonomy -

   e. Morphology -

   f. Deciduous -

g. Soil pH -

h. Herbaceous plants -

4. List the following:

a. Twelve main tree forms:

b. Seven fast growing trees:

c. Five slowing growing trees:

d. Seven problems or undesirable characteristics encountered when selecting trees:

e. Four reasons for selecting shrubs:

5. Discuss the effects of temperature, rainfall, and wind as factors to consider when selecting ornamental plants.

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